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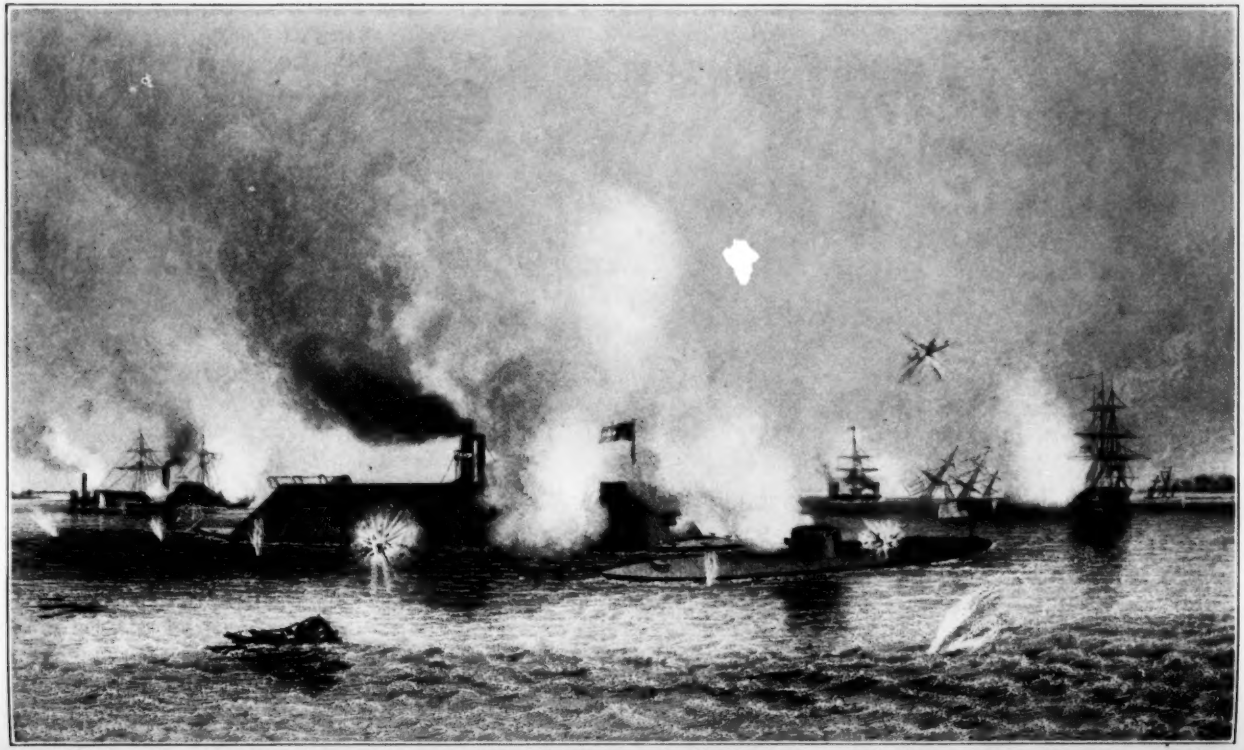

THE "MONITOR" AT HAMPTON ROADS

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THE "MONITOR" AT HAMPTON ROADS

THE SERVICE OF MARBLEHEAD TO THE UNITED STATES NAVY

BY CAPTAIN THOMAS G. FROTHINGHAM, U. S. R.

AUTHOR'S NOTE: At first sight it would seem incredible that the commission to the little schooner *Hannah* of Marblehead, depicted on the tablet shown in the accompanying picture, could mean the beginning of the United States Navy. Yet such is the fact, and this was appropriately recognized by the commemoration of the event at Marblehead on June 17, 1926. The Secretary of the Navy was present, with ships of the United States Navy, and this tablet was given to the United States Navy by the town of Marblehead.

The American Revolution broke away from all precedents in warfare, on the seas as well as land, and the following extraordinary sequence of events was typical of the enterprising spirit of our ancestors.

THE "birth of the United States Navy" must be held to consist in the first putting into commission of warships through the authority derived from the United Colonies of North America. No other definition will apply. As a matter of course, this rules out of the question the great numbers of American ships which were engaged in fighting on the seas in the years before the mighty forces of the approaching American Revolution fused into being the United Colonies of North America.

In the colonial times American ships had seen fighting on all the known seas. These ships were able and their crews were trained in a commerce where it was necessary to fight to preserve their ships. In those days ships were in constant danger from attacks by enemies and pirates. Not only were American ships armed for defense against these perils, but many of them had letters of marque, and mixed privateering with commerce. These ships received their authority to fight on the seas from various

sources, and it is self-evident that there was never anything approaching a united American authority. But it should be stated that this long experience in fighting on the seas gave the American colonists a preparation for naval warfare that has not been generally realized.

As a result, it was instinctive for the colonists, at the outbreak of the American Revolution, to fight the British on the sea, as well as on the land. In an astonishingly short time there was the beginning of the harassing naval warfare, which was destined to

become a decisive factor in the Revolution. As was natural, at first this warfare was irregular, with only local authority or with no authority at all. Many of the colonies had their so-called "navies." Ships were fitted out by private individuals and groups would organize expeditions. It was all spontaneous, with very little thought of what authority there might be for this fighting against the British on the sea.

In all of these adventures on the seas Salem has written for herself a noble history, which has been a matter of pride for every

true American. This record is so clear for all to read, that it would be a mistake to blur it by introducing issues altogether outside it. The same is true of the stirring parts played by different local communities in our early fighting on the seas. Ships were fitted out at Kingston, among many other seacoast towns. But not one of these enterprises against the enemy had a trace of any commission derived from the authority of the United Colonies.

It remained for the siege of Boston to bring into being the first armed naval force regularly commissioned by authority derived from the United Colonies of North America. It was the unerring instinct of George Washington which saw the need and created this force. And it was the town of Marblehead which provided the means by which this force was created. This is an important point in the history of the American Revolution, which has been very little known, and the strange sequence of events was brought about by unusual conditions existing at the time of the siege of Boston.

When General Washington took command of the American Army (July 3, 1775), Congress was still undecided as to the expediency of fitting out armed ships. However, Washington soon saw the importance of cutting off supplies brought by sea to the British Army shut up in Boston. For this purpose, he resolved to create a force of armed ships, and he accomplished this in a novel and ingenious way. He actually gave army commissions to the commanders of these ships, and put on board them detachments from his army as crews.

The mere statement of this extraordinary process for creating a naval personnel is surprising—and it would have been an impossibility in any other army. But Washington had found that in his own army there was a regiment of trained sailors, exactly suited for this duty. This was the regiment of Colonel John Glover of Marblehead, which was well called "amphibious." With this element to draw upon, Washington fitted out his fleet of armed ships, manned, as he himself wrote, by "soldiers who have been bred to the sea." "Bred to the sea" was a true description of these fighting men of Marblehead.

The first vessel of this fleet was the schooner *Hannah,* commanded by Captain Nicholson Broughton of Marblehead and manned by a detachment from Colonel Glover's regiment. The following from General Washington's instructions to Captain

Broughton (dated September 2, 1775), established the status of this vessel beyond any question:

> To Captain Nicholson Broughton: 1. You being appointed a captain in the army of the United Colonies of North America, are hereby directed to take the command of a detachment of said army, and proceed on board the schooner *Hannah,* at Beverly, lately fitted out and equipped with arms, ammunition, and provisions, at the Continental expense.
>
> 2. You are to proceed as commander of said schooner, immediately on a cruise against such vessels as may be found on the high seas or elsewhere, bound inwards and outwards, to or from Boston in the service of the Ministerial Army, and to take and seize all such vessels, laden with soldiers, arms, ammunition or provisions, for or from said army, or which you shall have good reason to suspect are in such service.

Following the instructions of Washington, the *Hannah* was fitted out by Colonel John Glover, "at the Continental expense," as he was reimbursed by the paymaster of the Army under a warrant issued by General Washington. Consequently, the *Hannah,* a Marblehead ship, was fitted out, commanded, and manned, by men from Marblehead. She sailed on her cruise September 5, 1775. That night she was chased by two British "ships of war," but on the following day Captain Broughton brought in a prize, the ship *Unity.* Captain Broughton reported this capture to General Washington on September 7.

This was something altogether different from anything that had hitherto happened in the American Revolution. It was the first warship regularly commissioned by the authority derived from the United Colonies of North America, and given a definite mission against the enemy. Moreover, this was not one isolated incident, but there was a sequence of events, which gave the commission of the *Hannah* a wide significance. Washington kept on and commissioned other warships in the same way. Congress was at length aroused, and on October 5, 1775, Washington was instructed to fit out two armed vessels to intercept two brigs loaded with munitions of war. Information of the sailing of these vessels had been received. A committee of Congress, called the "Naval Committee," consisting of John Adams, John Langdon, and Silas Deane, had been appointed.

Captain Broughton was put in command of the schooner *Lynch,* and made commodore of this expedition. Captain Selman of Marblehead was given the command of the schooner *Franklin,* and the two schooners sailed from Marblehead, "to the river

St. Lawrence, per the special order of Congress." The quotation from the report of Colonel Joseph Reed, General Washington's secretary, dated October 29, 1775, also gave the list of the armed vessels as follows: *Lynch,* schooner; *Franklin,* schooner; *Lee,* schooner; *Warren,* schooner; *Washington,* "a fine vessel"; *Harrison,* schooner.

It is evidence of the rapid course of events that Congress, on February 29, 1776, provided that "an addition of thirty-four dollars a month be added to the pay of Joseph Reed, Esq., Secretary to General Washington, on account of the extraordinary services attending the office by reason of the General's direction of the Navy Department."

From the preceding narrative it is evident that the project of Washington developed into an actual naval organization for the United Colonies, with authority from Congress. The little fleet was of real value throughout the siege of Boston. Its armed ships captured over thirty prizes, and thus did much to increase the hardships of the British Army in Boston. The schooner *Lee,* commanded by Captain John Manley, of Marblehead, was the most successful of these vessels. Captain Manley in November, 1775, took the most important prize of the siege, the *Nancy,* a large brigantine laden with muskets, ordnance, and ammunition, for the British Army in Boston. His ability won the approval of Washington, who made him commodore of his fleet on January 1, 1776.

Mention should also be made of Captain James Mugford, of Marblehead, who was in command of the schooner *Franklin.* On May 19, 1776, the *Franklin* was attacked by a strong expedition of boats from the British men-of-war, then lying off Nantasket. In a most gallant and desperate defense this ship was saved. Captain Mugford sunk two of the boats. But while fighting bravely, he received a mortal wound. He still continued to animate his men, exclaiming, "Do not give up the ship—you will beat them off!" In a few minutes he died. His men beat off the enemy's boats. . . . . The remains of Captain Mugford were carried to Marblehead for interment.

Thus, at the siege of Boston, Marblehead gave a gallant service in what proved to be the birth of the United States Navy. For, when the *Hannah* was regularly commissioned by authority derived from the United Colonies it was the first case of a commis-

sion that can be so described. The *Hannah* was unquestionably a Marblehead vessel. In the years preceding the revolution, the *Hannah* was owned by Jonathan Glover of Marblehead and employed by him in commerce. She was commanded by Captain Richard James, who was Glover's son-in-law. George U. Crocker has in his possession, among the Glover papers, many letters and other papers relating to the *Hannah* at this period.

As the *Hannah* was slow she was retained in the Continental service only a short time. Her commission derived its wide significance from the fact that it was the beginning of a regularly commissioned fleet. Not only this first warship but also the succeeding ships of this fleet were fitted out, commanded, and manned by men of Marblehead.

As these facts are matters of record, it was most fitting that the tribute of the United States Navy was paid to the town of Marblehead. Other towns and cities rendered brave service on the seas to the cause of American freedom, but this particular service was the part of Marblehead, and this was the birth of the United States Navy.

PERSONNEL TRAINING IN THE NAVY

By Lieutenant Commander (Retired) O. O. Hagen,
U. S. Navy

THE PROBLEM of personnel training in the Navy is ever with us, due to our large turnover of men. As this article is written, the Bureau of Navigation has indicated that 25,000 men will be recruited within the next year. While this is over the yearly average, it is probably safe to say that the average yearly turnover of men on all ships and stations will run between fifteen and twenty per cent. All officers realize the importance of having trained men at all stations, and all of them realize how hard it is to attain this desirable condition. It is hoped the article that follows may lead at least to discussion of methods and to improvements in the system now in use.

The Bureau of Navigation *Manual* states in detail the qualifications necessary for each rating in the Navy. These qualifications were made up by experienced officers in this bureau under direction of the Chief of Bureau and represent the standard of training necessary for every rating, in order that they may meet all emergencies in the Navy. That our men generally do not meet these requirements is evident to all officers. That this condition exists is due, primarily, to lack of time and to lack of a systematic and thorough schedule of divisional training. A discussion of these points will first be taken up, after which a proposed remedy will be submitted.

Lack of time is due to the importance given to gunnery training over all sorts of other training, and to the highly competitive efforts on all ships to outdo the others in "cleanliness and upkeep."

While the efficient use of the armament is, and always will be, the first consideration, yet it seems that it has, at the present time, taken on such importance that it has crowded out other valuable training. What training, for instance, is regularly held to land and seize a base, or to land an army? These operations demand highly-trained men in the care and operation of rifles, machine guns, and field guns; highly skilled crews for our motor sailing launches,

under power, oars and sail; men trained in infantry, especially extended order; highly trained artificers, etc. That this training is necessary is evident to most of us, who in our life time have known our Navy to land the Army in Cuba under trying conditions, and to send landing parties ashore in China, Nicaragua, and Mexico. Conditions still exist to warrant the importance of training in these lines. The history of our Navy points out fully the importance of having our personnel trained efficiently in all the duties as specified in the Bureau of Navigation *Manual*.

The other contributor to our lack of time, is our "ship's work." The time now taken for "ship's work" and for "cleanliness and upkeep" can well be cut down with proper organization. Bright work and bright steel work at the present time demand more man hours than is allotted for divisional training. An order that no bright work, not allowed during times of war will be permitted during times of peace, would immediately allow for a large expansion of time for necessary cleanliness and upkeep and more time for divisional instruction. A battleship battery was penalized ten per cent of its score due to the ship being "illuminated like a passenger ship" at night battle practice even though the commander battleship divisions, his chief of staff and gunnery officer, and others, stated that they looked carefully for and could not see a single light on the ship. The reflection of the moon on the wide-spread bright-work made the ship stand out like a lighted passenger ship to the observers on the towing ship several miles away. This bright-work took immeasurably more time to keep up than was allotted to any drills except possibly gunnery drills. The upkeep and cleanliness schedule should be made out as carefully by the heads of departments concerned as are other drill periods. Each department should have a schedule for the routine overhaul of all equipment and appliances pertaining to the department and this schedule should be placed in the ship's drill and work schedule each week. This would tend to efficiency in carrying out necessary work by letting division officers know what was expected of them. This pertains especially to the deck divisions which naturally come under more than one head of department. These weekly drills and work schedules should be made out under direction of the executive officer with cooperation from all heads of departments. Since drills and divisional instruction periods will ordinarily last for only one or two hours, there will be plenty of time, if effi-

ciently used, for necessary upkeep and cleanliness each day.

Our lack of a systematic and thorough schedule of divisional training is caused by a lack of a definite schedule for this training in the fleet schedules; a lack of a complete course of instruction for each rating which will assure each rating being trained in all the duties of his rating; and a lack of textbooks by means of which the men can study all the duties of their rating in a thorough manner, and at division instruction, receive aid from and do practical work under the direction of the division officer. These three points will be taken up in the order named.

The time for divisional training should be allowed for in the schedule for fleet training. Every commanding officer must be assured that this schedule for divisional training will be maintained. The details of the schedule on each ship must be delegated to each commanding officer, who is, naturally, responsible for the state of personnel training on his ship. The only exception to this rule would be where certain drills, involving more than one ship, as division or fleet landing forces, would require a definite place in the schedule. With the establishment of these definite training schedules, division or other unit commanders should carefully ascertain the efficiency of personnel training on the various ships at their routine inspections. These personnel training inspections should be given the same importance as is now given to "upkeep and cleanliness." If this were done, personnel training would immediately take its proper place in the front line of ship's activities.

With this lack of definite schedules for divisional training, it immediately follows that there can be no complete courses of instruction for each rating. The division officers can hardly be blamed for the failure to provide comprehensive courses of training for their men under these conditions. They would hardly be able to carry out any schedule which they did make. Officers are given only the ground work at the Naval Academy. They develop into efficient officers by constant training and association with the older officers and with men under them. Take this opportunity of training away from them and their development stops. Gunnery training alone, as now standardized, gives officers very little opportunity to develop that knowledge and leadership which commanding officers want to see in their officers-of-the-deck. The present system in most of the engineering departments gives those

officers little opportunity to assure the important leadership of their men which is their due, and which means so much to the efficiency of the department. Divisional training under the direct supervision of the division officer, with well defined schedules of training, is as helpful to the officers as to the men. This training, by its very nature, will increase the efficiency of the ship in every way. A gun crew made up of midshipmen first class can be developed into a prize gun crew in a few weeks' training where it will take years to do this with men not trained mentally to this high state of efficiency. We concentrate on physical training without realizing that mental training added to this will produce far greater results. We worry too much over the immediate problems at hand and keep our days filled by having untrained men do their work in two weeks' time, where a trained man would do it in one. We do not look ahead and realize that a few hours each week spent in scientific and efficient training will eventually increase the efficiency of each man so as to repay this time spent many times over in more efficient work. Besides, trained men do not desert or stay overleave or cause trouble. An excessive number of offenses on any ship is a sure sign that that ship lacks proper training.

A complete course of instruction for each rating can be secured most efficiently by using good textbooks designed to cover the duties of that rating. The lack of textbooks for use by enlisted men in conjunction with efficient divisional training is now overcome for nearly all ratings by the training courses issued by the Bureau of Navigation. These training courses are being improved, and new courses are printed as funds become available. These excellent training courses are not being used to any appreciable extent in the Navy. Officers, generally, know very little about them. Ships usually have an "educational officer" who issues out courses to men who ask for them. Sometimes officers will be detailed to assist men taking these courses. In most cases men have little or no help from the officers. Records in the bureau show that under these conditions, only one assignment is completed every two months by each man enrolled for a course.

It might be well to point out conditions in our Navy which make the use of these courses especially valuable. In the first place, our present recruits have a very high average in intelligence and training. Bureau records from analyses of recruits at each

training station show that about seventy-seven per cent of the men have completed elementary school education, and over half of these have completed one or more years in high school. These same records show that seventy-three per cent of these recruits made more than a mark of fifty per cent in the general classification test. Men of this type have an excellent foundation on which to develop a high state of efficiency in a very short time, if given a thorough, scientific course of instruction. Our Navy is especially fitted to give this type of instruction as we have the officers with the necessary qualifications to instruct. We have the ships and stations with their daily routine of work and drills which provide every facility for daily practical work in the courses given and which no laboratory could even approach for efficiency. We have the courses to form the foundation for this efficient training. With our highly intelligent men, these courses will provide the means for imparting this training in the minimum of time. A man today can learn more about electricity in ten minutes from a good textbook than Franklin could learn in his whole lifetime. As an example of what can be done with an efficient system of training, I will cite the case of the electrical officer on a certain battleship. This officer found himself confronted, soon after taking over the division, with about fifty per cent reduction of his allowed complement of rated electrician's mates, due to discharges in the near future. He instituted a daily instruction period for his whole division. All men not on watch were required to attend. The periods lasted only one hour, and weekly examinations on the work covered were held. All marks were posted every week. Within six months, this officer told me that the results obtained were far beyond what he expected. The new men had become efficient electrician's mates third class, and the others were far more efficient than before. The electrical department was better and more efficient. This latter point I can vouch for myself as I was in the gunnery department, and the increased efficiency of all electrical appliances in this department was decidedly marked. Instead of this hour per day interfering with the carrying out of the daily upkeep, it helped it out tremendously. The experienced men who were discharged during this time were hardly missed. This is an actual case of how divisional training, under an efficient division officer, using good training courses in conjunction with daily practical work, can work won-

ders in efficiency. It is just this type of training which, I believe, we should have for all divisions. It involves no radical departure from our established methods or organization. It simply puts our training of men on a scientific basis under their logical leaders, their division officers; under the supervision, of course, and the direction of their own heads of departments.

Training such as this would automatically do away with our Class A service schools with their 1,350 non-rated men. Conditions afloat are better in every way for giving more efficient training than can be given at these service schools, and these 1,350 men would be doing useful work for our Navy in the meantime. Our Class B and Class C service schools, with their 650 men, can then be further developed to fulfill their important mission, that of giving advanced and special training to competent and highly trained men from the fleet. Our present system of training has operated to cause commanding and other officers to look to our service schools for replacement of trained petty officers on board ships. They are not designed for this purpose, and rightfully not. Service schools, Class A, made up mostly of apprentice seamen knowing nothing of the Navy, with short crowded schedules, under no more efficient instructors than can be found on any ship or station, and with limited equipment, can no more make trained men for our Navy than a newly graduated ensign can be made into a trained C-in-C by a similar short course at the Naval War College.* These courses help the individual to a certain extent, undoubtedly, but their final benefit to the Navy as a whole is insignificant when compared to the good resulting from a general system of scientific training for all of the men.

The commander destroyer squadrons, battle fleet, in a circular letter to the destroyer squadrons, dated 7 July, 1926, desires among other things, in order to make those squadrons self-sustaining in rated personnel, that:

(Paragraph 1 [b]). Divisional instruction of training be continued and actively supervised by ship's officers.

* There is not, in the above comparison, any intention to belittle the importance of our Naval War College. This War College offers to trained officers the benefits now given to trained men by our service schools. All of these are indispensable to our Navy. They give a "post graduate" course of training in special lines which it is impossible to include in the routine training either afloat or ashore.

(Paragraph 1 [c]). The department's educational courses be used for divisional training and that men be encouraged to take these courses.

This system of training is exactly the system which all of our ships and stations should have. As training courses become available for the various ratings, these courses should be made the basis of all divisional training for that rating, and questions from these courses should be used in all examinations for advancement in rating. A seaman, coxswain, fire controlman, yeoman, fireman, water tender, cook, or carpenter's mate, wherever trained, or wherever advanced in rating, would then have a standard and efficient training.

The number and length of periods for divisional training will vary for the various departments aboard ship and will vary for various ratings in those departments. This is due to the fact that drills and practical work for some ratings will consist almost entirely of routine ship's work for that rating. At least three afternoon periods each week should be allotted to divisional training and these periods should be utilized so as to give the maximum amount of training to men of all departments.

Where the practical work or drills fit in with routine ship's work, as for instance, with yeomen, deck artificers, engineer artificers, etc., the divisional training periods need not be longer than one hour. During this time the officers should give personal help to all of the men in the work assigned for duty. Lectures, various experiments and special problems should be given by the officers to expand on the work covered and to make the courses more interesting. The courses studied should particularly apply to the duties being performed. The firemen, for instance, while overhauling boilers should be studying the course on boiler care and repair. While standing steaming watches they should be taking the course on boiler operation.

Where the practical work or drills consist of work outside of ship's work the divisional training periods should be about one and one half hours long. The first half hour should be devoted to personal instruction by the divisional officers on the work assigned for study. The remaining time should be spent in drill and this drill should follow as closely as possible the work assigned for study. For instance, if the subject studied is boats under oars the drill should be the same. If it happens to be ground tackle the drill can be "overhaul of ground tackle." If it happens

to be guns the drill can be "overhaul battery." Where drills are in the nature of necessary ship's work as in the latter two cases mentioned the period for this drill can automatically go on into the ship's work period which immediately follows.

The important points I wish to emphasize in this divisional training system are:

1. That the weekly schedule for ship's work and divisional instruction be carefully worked out together, and then carried out.
2. That the instruction, drills, and practical ship's work must be directly supervised by the heads of departments and division officers.
3. That training courses be made the basis for this divisional training, which by its nature is the professional training of the men in the theoretical and practical duties of their rating.

Assuming then an allotment of three periods per week for divisional instruction, each period to be from one to two hours long, the following schedule is proposed:

(a) The deck divisions come naturally under three departments, Navigation, Gunnery and C and R. The heads of each of these departments will have cognizance of such drills and instruction for the seaman branch as pertains to their department. The navigator will supervise all training for signals, steering, lookouts, etc., or all duties in connection with communications and ship control. The gunnery officer will supervise all training in gunnery, small arms, artillery, landing forces, etc., or all duties in connection with armament, fire control and landing force. The first lieutenant will supervise all seamanship, emergency drills, etc. The drill schedule must be made out carefully in order that each subject may be covered thoroughly by each division before going to another and so that the equipment for the various drills will be available for efficient training.

(b) The engineer divisions, under the engineer officer, should study the courses available, with stress placed on having men study first the equipment on which they are detailed in their daily duties. The firemen third class should be given lectures on general steam engineering and then required, in their practical work, to trace out all lines and engineering equipment on their own ship so as to give them a thorough knowledge of their own plant. After this, they are assigned courses like other ratings.

(c) The C and R department under the first lieutenant should study the courses available for each rating. The entire division instruction period should be devoted to this study. Their practical work is almost entirely "ship's work."

(d) The supply department under the supply officer should study the courses available for the various ratings. The entire division instruction period should be used for this purpose, their practical work being a part of their routine daily work. Mess attendants should be given courses in English, uniform regulations, and A to N, and oral instruction in their duties as specified in the Bureau of Navigation *Manual*.

(e) The medical department, under the medical officer, should study the courses available for their ratings. The medical department has uniformly carried out efficient personnel training with rigorous examinations for advancement in rating. Their efficient personnel is an example to all other departments of what can be accomplished with real training.*

New and revised courses are being printed each year. These courses are as complete as it is possible to make them. They are designed for, and can be used as excellent textbooks in the professional training of men at divisional instruction. Used in this manner, they insure a uniform, complete, and thorough course to all ratings in our Navy.

* In every case where courses are not available, or where they are not complete, the division officer should make up his own courses, following the requirements as laid down by the Bureau of Navigation *Manual* for each rating.

PROPOSED FUNCTIONS OF THE NAVAL AIRCRAFT FACTORY

By Commander R. D. Weyerbacher, (CC), U. S. Navy

THE NAVAL aircraft factory has played and will continue to play an important rôle in the development of naval aircraft. The report of the President's Aircraft Board chairman, Mr. Dwight W. Morrow, made certain recommendations relative to the functions of the naval aircraft factory, and also how to promote the civil industry. The following quotations are taken from the report:

. . . . . We find specific criticism of the continued operation of the naval aircraft factory. We believe that this factory should not be used on a production basis in competition with private industry, but that its maintenance for certain repair and experimental purposes is justified. . . . . It does, however, seem feasible to lay down a general policy.

It appears that it should be possible, at this stage of the development of the art, to select a given type of machine as a standard for two or three years, with the understanding that, barring some extraordinary development, no change would be made within that time. The industry would then be assured of a continuous series of orders for a standard design, while an excessive multiplication of types of equipment in service would be avoided. Those advantages seem to outweigh the small gain in performance of the individual airplane that might at times result from a willingness to put a new type into service every few months. There should be a standard rate of replacement, selected to give a complete turnover of service equipment at definite intervals, so that the number of new pursuit machines ordered, for example, might show no extreme fluctuations from year to year.

We therefore recommend:

(1) The adoption of a policy of continuity in orders and of a standard rate of replacement.
(2) Production orders be given only to companies which maintain design staffs of reasonable size and keep them active.
(3) Proprietary rights in design be fully recognized.
(4) Governmental competition with the civil industry in production activity be eliminated except in those projects impracticable of realization by the civil industry.
(5) During a period of production of a type accepted as standard there be placed a succession of small orders for experimental designs to be given limited service tests, the best of these designs

produced during a two or three year period being adopted as the next standard. Such orders, distributed among firms having design and production staffs of proven competence, should be awarded at a liberal price, high enough to cover all the overhead expense involved in the upkeep of the design and experimental departments.

(6) Existing statutes covering the procurement of supplies and requiring competitive bidding be modified where necessary to allow putting the recommendations previously made into effect.

For the naval aircraft factory to carry out the spirit and recommendations of the Morrow board report, and to develop economically a civil industry for rapid expansion to produce large volumes of naval aircraft, whenever the national emergency arises, this plan is proposed. (This was prepared during the fall of 1924, and has been modified only in a minor degree).

Functions of the Naval Aircraft Factory: The Bureau of Aeronautics *Manual,* [1923] defines the duties of the naval aircraft factory as follows:

Development and manufacture of experimental aircraft and aircraft accessories of a nature requiring confidential development or of a class of work that may be performed more expeditiously or more economically at that place than at civil plants. Also, a limited amount of aircraft production work, sufficient to maintain a nearly constant experimental working force and to obtain information on civil production costs. The naval aircraft factory will include in its activities the maintenance of the aircraft material storehouses and the maintenance and distribution of material therein, and the engine-testing laboratory.

This definition is so worded as to make possible a very wide variety and flexibility of interpretation. It is believed that aviation policies are reaching the point where they can and should be crystallized into definite and concrete plans for development extending over a period of years, retaining only that flexibility that is essential to all development. An interpretation of the duties of the naval aircraft factory that will accomplish this is suggested.

Present Needs of Naval Aviation: The factory should at all times be an instrument for serving the needs of the operating establishment. The one great material need of naval aviation at the present instant, is not a plane of one or more given types that is superior in performance or other qualities to any planes that have yet been built; the need is simply for reliable modern airplanes in sufficient quantity to make fleet and station operations

possible on an adequate scale. Given this, the development of superior types logically follows, and follows along lines of proven experience. Given this, naval aviation can be demonstrated to the fleet and to the nation, and its value proven beyond argument. Without this, no matter how certainly we in aviation *know* its value, the entire Navy will never be solidly behind development of aviation to its maximum potentialities.

The purposes for which planes will be used by the Navy have become quite definite. To provide the service with planes, it is suggested, first, that the best type of plane suitable for each purpose be decided upon—the type chosen to be actually now flying, and not in the design stage or under contemplation,—and, secondly, that a sufficient quantity of these planes to supply adequately the service for three years be ordered on production contracts with civilian concerns.

It is absolutely necessary to keep our civilian aircraft manufacturers supplied with sufficient work to enable them to exist. Such production contracts, placed at figures which allow reasonable profits, will not only supply this necessary work, thus having civilian organizations available for aircraft construction at times of national emergency, but will keep the contractors in touch with naval aircraft needs and may lead to valuable suggestions covering improvements in design.

The Use of Competitive Designs: The system that has been in recent use, that of securing development by competitive design, undoubtedly has certain important advantages. The practice has been, however, to require manufacturers not only to submit designs, but to build two or three actual planes. Production contracts are then awarded to the lowest bidder for the construction of planes, chosen on the basis of the comparative performance of completed planes. This method is not only costly for the department, but it is unsatisfactory to the civilian contractors. It is impossible to frame a contract covering new design and construction, which will be acceptable to civilian contractors and still adequately safeguard the government. Aeronautical contractors must gamble on the acceptance of the two or three planes they build in competitive designs, in hopes of a large production order, and those who are not awarded a production contract must recoup their losses as best they can on claims for additional work or

alterations not covered by contract. Production orders as suggested in the preceding paragraph, on the other hand, put them from the beginning on a sound, industrial basis.

In order to retain all the desirable features of the present system, experimental planes must be built somewhere from competitive designs. In order to prevent duplication of effort and repetition of unpromising attempts, design development and experimental construction within the Navy should principally be concentrated at the same point. Then, when it became desirable to ask for competitive designs, only those designs, or parts of the designs that give great promise would be accepted and passed on for development and experimental construction. It is, therefore, suggested that almost all detail design and all experimental construction be concentrated at the naval aircraft factory, since this is work to which it is peculiarly adapted.

Since operation of an aircraft factory, even on production orders, requires a small engineering force, the concentration of the principal amount of experimental construction elsewhere would not cause the contractors to do away with their design facilities. It would, therefore, still be possible for the Department to ask for competitive designs, at the same time permitting these contractors to operate small design departments and large production departments at maximum efficiency, with a resulting minimum cost to the government.

The present appropriation for aircraft allows only a limited amount for new construction. If each commercial aircraft organization, in order to compete in preparation of new designs, must keep a design force capable of preparing drawings in detail sufficient for construction purposes, the costs of the plans will be out of all proportion to their value, and the limited aviation funds will be spent unwisely.

It would be possible, however, for the commercial organizations to prepare *type* plans, in competition, with the small design force necessary for productive work, and at small cost as compared with the cost of detail plans. The bureau could then study the designs submitted, choose the most promising, or possibly combine the best points of several, in order to develop a design to give the improvements desired. One complete set of detail plans could then be prepared instead of a complete set for each competitive design

submitted, and the logical place for the preparation of most of these detail plans is the aircraft factory.

Experimental and Development Work at the Naval Aircraft Factory: The following plan for controlling experimental and development work at the factory is suggested as one which is both economical and well adapted to giving operating units confidence in what is being done for them. A small number—some eight or ten—pilots, with good service reputations and adequate engineering education, and each with special experience in a given class of aircraft, should be carefully selected, and assigned to the naval aircraft factory for duty as project flight engineers. At least two of the planes of each class that will have been decided upon to fill immediate needs, should be sent to the factory. It would be the duty of the factory pilots to thoroughly familiarize themselves with the past history and development of the types of planes to which assigned, and to keep in touch with contemporary development elsewhere. All improvements and suggestions regarding these types, that originate with operating units and elsewhere, should be examined by the pilot in charge of each type, and if at all feasible, should be incorporated in these planes and tested at the factory by these pilots. If the suggested changes are demonstrated to be improvements, and approved by the bureau, they should then be generally adopted. At the same time, new designs of a type, whether originated within the Navy itself, or accepted for experimental construction, would be placed under the engineering supervision of this same pilot. Civilian engineers and technical assistants would be provided from the present force of the factory to supplement the professional knowledge of the engineer-pilot.

When experimental planes had been completed, thoroughly tested, and thought of sufficient promise to warrant replacing planes of that type in service, they should be sent to an operating unit, in charge of the engineer-pilot, for service tests, before production contracts are placed.

The pilot would know thoroughly the reason for every feature about the plane, would be familiar with all compromises that have usually been necessary, and would be in the best position to work with the operating unit in its appraisal, ready to forestall needless criticism and ready to accept useful suggestions, as he would be most desirous to see his plane put in service. Only

after thorough demonstration to, and acceptance by the operating unit would the production contracts be let.

After demonstration as noted above and when production contracts are let, a building program could be arranged which would replace planes already in service with a minimum scrap value on the old planes. Also, there would be assurance that the new plane would be actually an acceptable improvement, and that the old ones would not have to be once more placed in service due to failure of the new types to fulfill expectations.

Under such conditions it should be possible to build up and perfect, at the aircraft factory, a testing technique of such an order that all test work could be concentrated there, thus affecting another economy and an additional conservation of effort.

Proposed Use of Metal Construction: At the end of the last war, spruce for airplane construction was costing the government about $1,000 per M board feet. Not only may the price of spruce go higher in case of another war but the amount available for airplane construction is limited.

Metal airplanes in large production can be manufactured more cheaply than airplanes constructed of wood provided the design considers mass production. For a given size and strength, plane structures built of metal are lighter than those built of wood. For this reason, and because of the uncertainty as to the supply of suitable timber national security requires that in the next war airplanes be of metal construction.

It is proposed, therefore, that each of the existing service types of airplane be re-designed for metal construction. The department would decide whether a saving of weight is to be applied by reducing the size, maintaining the same military load, or whether the size should remain constant and the military load be increased. Several of each of the types should be built of metal and given a thorough service test with operating units.

Proposed Plan for Quantity Production in Time of Emergency: In order to develop a plan whereby these various types may be put into quantity production in case of national emergency, it is proposed that one of the existing airplane manufacturing companies be designated to construct a certain one of each of the approved types. Surveys should be made of the manufacturing plants in the near vicinity of the manufacturer selected for building each type, and a plan of work developed, so that planes of

that type can be economically manufactured in large quantities. In war, emergency parts would be manufactured in the surrounding factories and assembly made at the plant of the airplane manufacturing company. This plan would be followed out for each of the approved types of aircraft. In peace time, each manufacturer selected should be permitted to build several of his assigned type, in order to test out the plan of work.

Furthermore, since the metal airplane is the most logical type for war time construction, it should be used in peace-time operation; therefore, the manufacturer selected for each type could always maintain a fairly constant force working on the number required for peace-time operation. By the plan outlined above this peace-time force would serve as a nucleus for the larger force required for war-time operation.

The Navy Department should keep the development of all types of planes, and this development should include a complete and correct set of plans and specifications including designs for jigs and fixtures.

The naval aircraft factory has developed a high technique in metal construction, and, therefore, is best qualified to proceed with a large portion of the development of metal types, and to keep corrected for each approved type a set of plans and specifications, including designs for jigs and fixtures, for the use of the bureau in placing commercial contracts.

Aircraft Costs: In estimating for new ship construction, the Navy Department has been seriously handicapped by not having accurate cost data. Because the private shipbuilding plants have been long established and have such data, and their bids on proposed ship construction were usually very close together, it has always been desirable for the government to build, at various times, different types of ships, in order to know what can be done, and the costs for the various kinds of work. This also applies to aircraft, and, as the aircraft industry becomes more stable, it will become more necessary for the department to build, in government establishments, various types of aircraft, in order to determine costs.

The government's policy is not to build all of its requirements, for it is necessary to keep alive industry whose profits should be reasonable.

There has been a considerable amount of controversy about government costs, but my experience has shown that government costs are, at times, comparable to those of outside contractors. The government has available experienced personnel and equipment for aircraft construction work, and, therefore, the Navy Department, by the proper distribution of its trained personnel and by proper organization, can have government work done at the cost of the private manufacturer, less his profit.

As the *Manual* of the Bureau of Aeronautics implies that it is necessary to place a limited amount of aircraft production at the aircraft factory, in order to maintain a nearly constant experimental working force.

Under the system outlined above, two or three planes of all types that are later placed in commercial production will be built at the factory. Such construction will give information on civil costs for given types of planes, will give the Navy itself desirable experience in construction difficulties, and will keep drawings centralized and available in one place for future orders. Such work, however, will not be in quantity production of the sort necessary to maintain a constant force. Reconditioning and overhauling of aircraft have been used in the past as fill-in work for the factory, but this work is of the type that can be more expeditiously undertaken at repair bases such as Hampton Roads, San Diego, or Pensacola, where organizations are in existence for that purpose alone. In order to utilize the factory organization to best purpose, it is suggested that such overhaul and repair work be reduced to a minimum, and that, instead, for fill-in production work to absorb idle time, the factory be given orders for new spare parts. The quantities of these spare parts should be sufficient to partly supply the requirements of the planes built under commercial contracts, and should be so chosen that they are those parts uneconomical to reproduce by the civil industry.

Since new construction in quantity is after all the only type of real aircraft production work that exists, this is the class of production work which should be carried on at this factory, as its organization is much better adapted to such work than to overhaul and reconditioning.

Summary and Conclusions: To put into effect the plans outlined above would require:

Legislation: (1) Authority for the Navy Department to place contracts without competitive bids at a price which will include a reasonable profit.

Personnel: (1) Assignment of about eight expert pilot-engineers to the naval aircraft factory to act as project engineers for the various types of planes required.

Material: (1) Transfer all experimental design development and experimental construction and testing to the naval aircraft factory; (2) Build at the naval aircraft factory, several of the various types of planes, in order to determine costs; (3) Give the naval aircraft factory sufficient orders for spare parts to absorb idle time; (4) The department is to select the key manufacturer and develop a plan of work, so that the various types of planes which are standard can be manufactured in large quantities in case of an emergency.

Pending the passage of necessary legislation, as noted above, the authorization for, and initiation of changes suggested under "personnel" and "material" would increase the effectiveness of the factory to a very marked degree. These changes are not dependent upon legislation, and regardless of whether peace-time authority for non-competitive contracts may be granted, these changes in policy would be of immediate benefit to the service.

Putting the aircraft factory on the basis indicated above would make maximum use of its highly perfected organization, with its trained design personnel, its extensive testing equipment, including the aeronautical engine laboratory, its excellent shop equipment, and its facilities for operating both seaplanes and land planes. The naval aircraft factory would then fulfill its stated duties, and in so doing, would make a far better experimental construction plant than it would an air depot, into which work might be put primarily for convenience.

HISTORIC SHIPS OF THE NAVY

By Robert W. Neeser

"Monitor"

THE *Monitor* was an ironclad steamer of the third rate built by contract by John Ericsson and the Continental Iron Works under authority of the Act of Congress approved August 3, 1861. Her cost was $275,000.00. The general plan of the vessel was little less than an inspiration of genius. It called for a small iron hull, upon which rested a large raft, surmounted by a revolving turret. The dimensions of the vessel were: burden, 776 tons; length, 174′; breadth, 41′ 4″; depth of hold, 12′; draft, 10′ 6″. The machinery was built by the Delamater Iron Works of New York, and consisted of Ericsson vibrating lever engines of 26″-stroke, for which steam was supplied by two return tube boilers. The turret, which was built up of eight layers of 1″-iron plates bolted together, was nine feet high and had an inside diameter of twenty feet. It contained two 11″-Dahlgren guns, which protruded from circular port-holes just large enough to admit their muzzles. The sides of the vessel were protected by 4½″-iron, and two half-inch plates covered the flat deck. The pilot house was placed on deck, in front of the turret, being built of square iron bars notched together with a bolt through the corners. The crew numbered forty-nine men.

The keel of the *Monitor* was laid on October 25, 1861, and so rapidly was the work carried forward that she was launched on January 30, 1862. Nineteen days later she went out on her first trial trip, and on February 25 she was formally commissioned at the New York Navy Yard, New York, by Lieutenant John L. Worden. On that occasion the main engines, the steering gear, the turret turning mechanism, almost everything worked imperfectly, but these defects were soon adjusted and on March fourth a final and successful trial was run, the guns also being tried at this time.

The Navy Department originally intended to send the *Monitor* to the Gulf of Mexico to assist Flag Officer Farragut in his

THE LOSS OF THE "MONITOR"

From a Wartime Print

operations against the defenses of New Orleans, but the alarming news of the completion of the Confederate iron-clad *Virginia* at Norfolk, Virginia, caused these orders to be cancelled, Lieutenant Worden being directed instead to sail for Hampton Roads, Virginia, without delay. At 11 A. M., on March sixth the *Monitor* put to sea and stood down the coast in tow of the tug *Seth Low* accompanied by two unseaworthy gunboats. The wind was moderate, but on the second day out it freshened to a strong breeze from the north-west. The sea increased so that the deck was swept and much water was forced below through the hawse pipes and under the turret. Several waves broke over the smoke-pipe and blower-pipe, causing the blower bands to slip and break. This stopped the draft in the furnace, and filled the engine room with gas, the two engineers having to be rescued as they lay unconscious on the floor. The fires under the boilers now ran down so that neither the propelling engines nor the pumps would work, and bailing had to be resorted to, the buckets having to be passed up through several hatchways from the hold to the top of the turret. The tug was directed to steer inshore, and after five hours of steaming, the vessels came into smoother water. There the engine room was cleared of gas, the blower-bands were repaired, and the engines once more functioned.

Thus matters continued until shortly after midnight, when, in crossing a shoal, the *Monitor* suddenly ran into a heavy head-sea. The water came up through the anchor-well in such quantities that the berth deck was flooded. Efforts were made to close the hawse-pipe. The rush of water was partly checked, but about this time the sea began coming down the blower-pipes again, threatening disaster. The head wind prevented Lieutenant Worden from hailing the tug, and in the hurry of preparation no arrangements had been made for signalling at night. Every sea that dashed spray over the blowers was anxiously watched. Every few minutes word came from the engineers that the engine could not be kept going much longer unless the water was kept out. To add to the anxiety, the wheel ropes jumped off the steering wheel, owing to the pitching of the vessel, and became jammed. The iron-clad was now unmanageable and began to sheer about wildly. But fortunately the tow-rope held, and at dawn the tug managed to bring her stricken consort into smoother waters.

THE LOSS OF THE "MONITOR"

From a Wartime Print

As the *Monitor* passed Cape Henry at four o'clock in the afternoon of March eighth, her crew heard the booming of heavy guns and when the pilot came on board, they learned the news of the disastrous engagement that had just ended in Hampton Roads. Lieutenant Worden at once began active preparations for battle. The turret was keyed up, the ship was cleared for action, and by the light of the burning *Congress* the small iron-clad steamed up the bay to the scene of battle. At 9 P. M. she anchored near the *Roanoke,* and Lieutenant Worden went on board to report. Captain Marston had received orders from the Navy Department to send the *Monitor* immediately to Washington, but in view of the great emergency, he decided to disregard these instructions and to send the *Monitor* to protect the *Minnesota,* which was aground off Newport News, Virginia.

At daylight on the morning of March 9, the *Virginia* was seen coming towards the *Minnesota,* as though to complete the work she had left unfinished the previous night. The frigate lay still in the same position, helpless. The diminutive ironclad beside her apparently attracted no notice. But as soon as the *Virginia* opened fire upon the *Minnesota,* the *Monitor* headed directly for the enemy. Lieutenant Worden reserved his fire until he was close upon the *Virginia.* The latter replied, but with little effect. The turret was a small target, and most of the projectiles passed over the low deck. Such of the enemy's shot as struck the turret, glanced off from its curved side. After passing the *Virginia,* Lieutenant Worden turned, and crossing her stern, attempted to disable the screw, but he missed his aim by a few feet.

The two antagonists now ranged alongside each other, firing deliberately. Both of the *Monitor's* guns were fired while the ships touched, the two shots striking almost in the same place, crushing in the iron and the wooden backing, but failing to penetrate. The concussion was terrible. Many of the *Virginia's* men were knocked down at the guns, causing some of them to bleed at the nose and ears.

Presently the vessels separated. The *Virginia* attempted to engage the *Minnesota* again, but the *Monitor* again intervened. After several ineffectual broadsides the Confederate ironclad ran towards her small antagonist at full speed in an effort to ram her, but Lieutenant Worden saw the movement in time and put his helm hard-a-port, so that only a glancing blow was received.

The engagement had now lasted almost two hours, and the supply of shot in the *Monitor's* turret was exhausted. She therefore hauled off to hoist up a fresh supply from the hold. After fifteen minutes, Lieutenant Worden renewed the action. But this time the enemy, realizing the futility of injuring the *Monitor's* turret armor, trained his guns upon the pilot-house, in which Lieutenant Worden and the helmsman were stationed. This was the weakest part of the vessel, and it was not long before a well-directed shell exploded in front of the slit through which the commander of the *Monitor* was looking. The latter's eyes were filled with powder and slivers of iron, and he was blinded and stunned. The vessel sheered off and it was some minutes before word reached Lieutenant Samuel D. Greene, who was in charge of the turret, of the disaster in the pilot-house. The latter immediately assumed command and once more headed the *Monitor* for the enemy, but the *Virginia* was already retiring towards the Elizabeth River, and Lieutenant Greene had only time to give her two or three parting shots before she got out of range.

The *Monitor* was struck twenty-one times during the engagement and fired forty-one 11-inch solid shot from her two guns. The only serious casualty she received resulted from the shell which struck the pilot-house. The deepest indentations on the sides were four inches, on the turret two inches, and on the deck one inch. Two of the *Monitor's* crew were temporarily disabled by concussion, but their injuries were slight.

No single event of the war produced more momentous results than the victory of the *Monitor*. The news of it spread throughout the world and attracted the immediate attention of the maritime nations of Europe. The days of the old wooden war vessels were numbered, and in England the government went so far as to assemble a defense commission to consider "the effect of the recent engagement that had taken place in the Chesapeake between the naval forces of the United States and the Confederates," and its bearing upon the erection of the Spithead forts.

After the withdrawal of the *Virginia*, the *Monitor* remained in Hampton Roads. Lieutenant Thomas O. Selfridge, Jr., was in charge of her for a few days until Lieutenant William N. Jeffers, who was ordered to the ship on March 13, could join her. About the middle of April the Confederate ram appeared at the mouth of the Elizabeth River for the second time, but she did not venture

within range of the Union guns. On May 8, three gunboats made a demonstration against the batteries at Sewell's Point, Virginia. The *Monitor* was kept well in advance, so that the *Virginia* could engage her without difficulty if she desired to do so, but she declined the invitation. This proved to be her last opportunity to meet the *Monitor*. A few days later Norfolk was retaken by the Union troops, and the Confederate ram, unable to leave the river, was destroyed by her crew to prevent her capture.

On May 15, Lieutenant Jeffers was directed to join a flotilla which was to attempt to reach Richmond by way of the James River. The gunboats met with no obstruction until they reached Drewry's Bluff, Virginia, about eight miles below the Confederate capital. But there they encountered a number of extensive fortifications, while sunken steamers and hulks blocked the channel. The action soon became general, but the *Monitor* could take no part in it as her guns could not be elevated sufficiently to reach the enemy's works on the bluff. She therefore withdrew out of range, but not before she had been struck three times.

After remaining in the James River all summer, in charge of Commander Thomas H. Stevens (August 16, 1862), the *Monitor* was sent to Washington, D. C. for repairs. On her return to Hampton Roads, November 15, 1862, she was directed to fit out for service on the North Carolina coast. She sailed on December 29, 1862, under the command of Commander John P. Bankhead, in tow of the *Rhode Island*. All went well until the morning of the second day, when the ships began to feel a swell from the southward. Gradually the wind freshened. The seas began to break over the pilot-house of the *Monitor*, and in the evening off Cape Hatteras matters began to grow worse. The experiences of her first voyage from New York were renewed, but this time the inrush of the water could not be checked. The *Rhode Island* was stopped to see if the ironclad would not ride more easily or make less water, but the inert mass of iron only fell off and rolled heavily in the trough of the sea. Then the strain on the forward overhang loosened the plates under the bow, and the ship began to leak. All the pumps were set working, but the water gained on them so fast that by ten o'clock in the evening it became evident that no efforts would avail to save the ship. Commander Bankhead made the signal of distress, cut the hawser, and ranged up under the lee of the *Rhode Island*. Boats were lowered, and

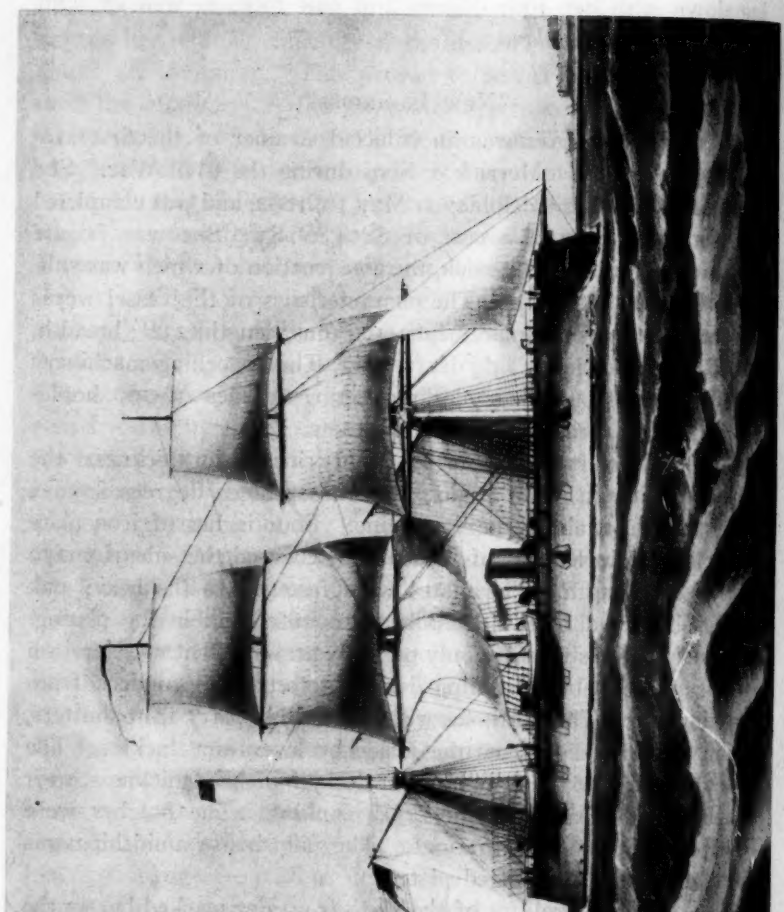
nearly all of the crew were taken off, when, about 1:30 A.M. on December 31, the *Monitor* slowly settled and disappeared, carrying down with her four officers and nine men, as well as eight men of the *Rhode Island*.

"New Ironsides"

The *New Ironsides* was an ironclad steamer of the first rate built by contract by Merrick & Sons during the Civil War. She was launched at Philadelphia, on May 10, 1862, and was completed three months later at a cost of $814,866.83. She was frigate built, with a hull of white oak, the construction of which was sublet to Cramp's shipyard. The characteristics of the vessel were: burden, 3486 tons; displacement, 4120 tons; length, 232′; breadth, 57′ 6″; depth of hold, 23′; draft, 15′. The propelling machinery consisted of two horizontal direct-acting engines of 700 horsepower. Her average speed was six knots.

The wooden frame averaged twenty inches in thickness, the sides tumbling in at an angle of about seventeen degrees from a point three feet above the water-line. Four inches of iron plate armor, rolled in lengths of fifteen feet, covered the sides for 170 feet of her length. The plates were fastened to the heavy oak frames by wood screws, their heads countersunk in the plating. The ends of the ship were only partially armored, but massive iron bulkheads, with heavy sliding doors, protected the gundeck from a raking fire. The portholes were fitted with heavy iron shutters, which were handled from the inside by levers and tackles. The spar deck was covered by an iron deck, 1 inch in thickness, over which was laid a 3½″ pine deck planking. The hatches were fitted with heavy iron gratings. The pilot-house amidships was built of ten-inch laminated plates.

The offensive qualities of the *New Ironsides* marked her as the most powerful ship of the period. She never had occasion to make use of her projecting ram bow, but her battery played an important part in the battles in which she took part. Fourteen 11-inch Dahlgren smooth bore guns and two 150-pound Parrott rifles were carried in broadside, while two 50-pound Dahlgren rifles were placed on the spar-deck fore and aft. All the guns were mounted on iron carriages, the first of their kind to be used in the Navy. The crew of the *New Ironsides* numbered 449 men.



U. S. Ironclad Steamer, "New Ironsides"

U. S. IRONCLAD STEAMER, "NEW IRONSIDES"

The ship was placed in commission at the Philadelphia navy yard, on August 21, 1862, by Commodore Thomas Turner. Her first service was at Newport News, where she remained for several months, while the mechanics were putting on the finishing touches. Early in the following year she was sent to re-inforce Rear Admiral Du Pont's squadron off Charleston, South Carolina, where several Confederate rams were threatening to raise the blockade, which was only assured by a few wooden steamers.

On April 7, 1863, the *New Ironsides,* with the admiral and his staff on board, led an attack against the Charleston forts. Seven monitors and the *Keokuk* were in the line of battle. The plan of the admiral was to run by the batteries on Morris Island and move up the channel within easy range of Fort Sumter, which was to be subjected to a deliberate and accurate fire. A reserve squadron, consisting of five wooden ships, was to remain outside the bar, in readiness to support the ironclads when the latter became engaged.

At noon the signal was made to get under way, the *Weehawken* leading with a wooden raft attached to her bow to explode any torpedoes that might be encountered. Three other monitors followed her, and then came the *New Ironsides,* forming the center of the battle line. The ships soon came under the concentrated fire of all the shore defenses, which during the two hours that the engagement lasted fired 2,209 shot, shell and rifle-bolts. The monitors had no difficulty in reaching the positions assigned to them, but the admiral was unable to bring the flagship into close action as in the rapid current and narrow channel the vessel became unmanageable. Twice she had to anchor to prevent grounding, and once on account of a collision with two of the monitors. Only eight of the guns were fired, and then only once, the smoke being so dense in the channel that the guns could not be trained properly, and soon after the commencement of the action the ship fell off so that none of her guns could be brought to bear upon the forts. The side armor was struck about fifty times, none of the shots penetrating. One of the port shutters was carried away, the smokestack was perforated once, and two shells entered the unarmored bow, causing slight damage to the woodwork in that part of the ship.

Altogether her first essay under fire was anything but a success, and following the withdrawal of the squadron nothing further

was attempted for several months. Most of the ironclads were withdrawn for repairs, leaving Commodore Turner off the port to support the wooden vessels of the blockading force. With the resumption of active operations in July, there began a series of attacks during which the *New Ironsides* earned a reputation for being more thoroughly hammered than any vessel that ever floated. According to the official reports, she returned the compliment with 4,439 shots fired from her heavy broadside guns during the summer months of 1863.

The naval attacks against Charleston were made in cooperation with the movements of General Gillmore's army, which was concentrating its first efforts against Fort Wagner on Morris Island. Several monitors shelled the enemy's works on July tenth, and in the following week the *New Ironsides,* under the command of Commodore Stephen C. Rowan (July 7, 1863), joined in a general bombardment of their position. The ship was anchored within 1,200 yards of Fort Wagner, which opened a furious fire upon her, but her powerful broadside soon drove the Confederate gunners to their bombproofs. The action was kept up until dark, when the Army attempted to carry the fort by storm, but after desperate fighting they were obliged to withdraw with heavy loss, although at one time the assaulting column had partial possession of the enemy's parapet. During this attack the *New Ironsides* expended six hundred and sixty-five 11-inch shell, fifteen shrapnel, and one thousand six hundred and twenty-five 150-pounder rifle shell. She was struck but ten times.

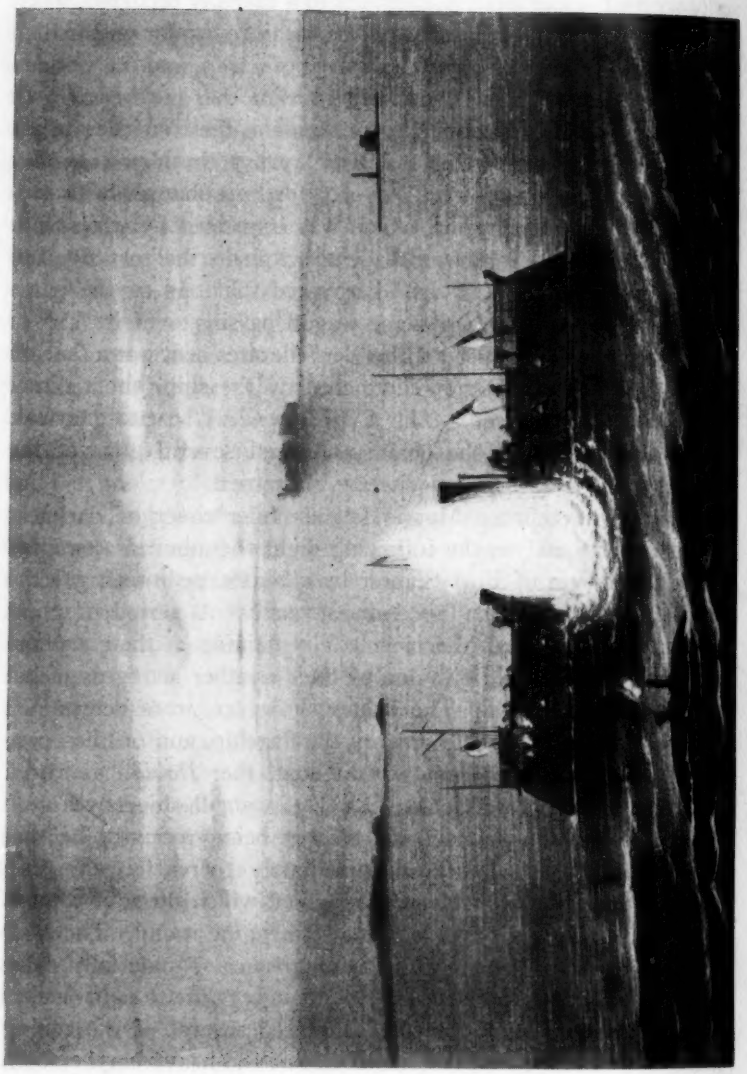
It was evident that the Confederate works on Morris Island could be taken only by regular siege operations. The naval vessels aided the troops by engaging the enemy's attention, while they worked on their batteries. In these attacks the *New Ironsides* frequently took part[1], her battery causing more annoyance to the defenders of Fort Wagner than all the guns on board the monitors. She was frequently struck, and on one occasion, when on an exceptionally high tide the ship was placed within nine hundred yards of Fort Sumter, she was hit thirty-one times, without sustaining any important damage. The smoke stack was completely riddled, the iron ceiling of the spar deck shattered in several

[1] She attacked Fort Wagner on July 20, 24, 29; August 17, 18, 20, 21, 22, 23; Fort Sumter on September 2, 5 and the batteries on Sullivan's Island on September 7 and 8.

places, and an occasional port shutter was knocked off. But the side armor was never penetrated, and no one on board was very seriously hurt. The nearest approach to a casualty occurred, when a shot from Fort Wagner shattered a rammer-handle with which a sponger was ramming home the charge of a gun, and the wooden splinters from the handle wounded some of the gun's crew. In connection with this immunity from accident, the Confederate accounts reveal that during the attack of April 7, the *New Ironsides* lay for nearly an hour directly over a torpedo charged with two thousand pounds of powder, which was connected by wires with the shore. Every effort was made to explode the torpedo, but without success. Later it was discovered that one of the wires had been severed by an ordnance wagon passing over it.

On the night of August 21, the Confederates sent out a "steam torpedo boat" which attempted to destroy the ship, but a direct collision was not effected. The *New Ironsides* "beat to quarters, fired a rocket, slipped the chain, and fired several guns at the stranger," who succeeded in effecting his retreat.

The enemy evacuated Morris Island under cover of darkness on September 6 and on the following night the admiral attempted to gain possession of Fort Sumter by a boat expedition from the squadron, but the latter failed disastrously. A period of comparative quiet followed, the ironclads remaining at their anchorages off Morris Island, with one of their number acting as picket at the harbor entrance. The enemy, however, were determined to make another attempt to destroy the flagship, and on the evening of October 5, another torpedo boat, the *David,* ventured among the Union vessels. At 9:15 P.M. a small object was seen by the sentinel and hailed. No answer being received, he discharged his musket. Almost immediately thereafter, the ship received a severe blow from an explosion, which threw a column of water upon the spar-deck and into the engine room. The *New Ironsides,* with her usual good fortune, was not materially damaged. The explosion drove in one hanging knee, eight inches below the water-line, broke and splintered several of the ceiling planks, and crushed into fragments one of the heavy engine room beams. The *David* was nearly swamped by the concussion and the descending water, but she succeeded in returning to Charleston, although her commanding officer, Lieutenant Glassell, and one other officer were taken prisoners.



THE REBEL TORPEDO BOAT, "DAVID"

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After this experience the *New Ironsides* was surrounded by fenders rigged out from her side supporting a stout netting. A powerful search-light was kept in operation every night, and small boats rowed guard on moonless nights. But the Confederates made no more attempts to torpedo her, and no further incident occurred to break the monotony of her blockade duty off Charleston. In the latter part of May, 1864, the ship was ordered to Philadelphia, where she was repaired and refitted for active service.

A new commission dates from August 22, 1864, with Commodore William Radford in command. The ship rejoined the North Atlantic Blockading Squadron in Hampton Roads, where the largest naval force that ever sailed under the Union flag was being assembled by Rear Admiral Porter for the purpose of reducing the defenses of Wilmington, North Carolina. Fort Fisher, which guarded the New Inlet entrance to the Cape Fear River, was one of the most formidable earthworks on the Atlantic coast. The parapets were twenty-five feet thick, with an average height of twenty feet, while the traverses, ten feet higher, were ten to twelve feet thick. Seventy-five guns of various calibers were mounted in the works, which were garrisoned by one thousand troops.

On December 18, the *New Ironsides* was directed to proceed to the rendezvous twenty-five miles east of New Inlet, and from there the fleet stood in to the attack six days later. Leading the ironclad division, she "took her position in the most beautiful and seamanlike manner, got her spring out, and opened deliberate fire on the fort, which was firing at her with all its guns . . . . they were silenced almost as soon as the *New Ironsides* opened her terrific battery."[2] In the afternoon General Butler came in with a few transports, but it was too late to do anything more, and the disembarkation of the troops was not begun until the following morning. The fleet then resumed the bombardment, and again silenced the fort, but the army commander decided that it would be unwise to assault the land face of the works, and the soldiers were ordered to return on board their transports.

But Rear Admiral Porter was determined that the attack should succeed, and after refilling the bunkers and magazines of his ships he returned to New Inlet to await the arrival of another force, which the Navy Department assured him

[2] Rear Admiral Porter to the Secretary of the Navy, December 26, 1864.

THE REBEL TORPEDO BOAT, "DAVID"

would be "properly commanded."[3] Heavy weather delayed operations for forty-eight hours, but the sea moderated enough by January 13, 1865, to allow the admiral to renew the bombardment. The *New Ironsides* and the other ironclads took up their former positions within 1,000 yards of Fort Fisher. "Quite a spirited engagement went on," wrote the admiral, "but it was soon apparent that the iron vessels had the best of it; traverses began to disappear and the southern angle of Fort Fisher commenced to look very dilapidated. The guns were silenced, one after the other, and only one heavy gun in the southern angle kept up its fire." The wooden ships joined in the attack, and one of the most terrific bombardments in naval annals was maintained for several days. It was estimated that no less than four shots were fired from the fleet every second, or almost seventeen thousand in all, and the garrison was kept within their bomb-proofs practically all the time.

On the third day of the attack, the army force sent forward its assaulting columns, while a detachment of sailors and marines created a diversion along the beach. The Confederates swarmed the bastion to meet the naval "boarders," but while they were successful in meeting this danger, they failed to hold in check the Union troops on the western face. The storming party there gained a foothold on the parapet, and after hand-to-hand fighting of the most desperate character, soldiers carried nine traverses in rapid succession.[4] The last of the defenses surrendered shortly after ten o'clock, and the fleet celebrated the victory by firing hundreds of rockets, which illuminated the sky and apprised the defenders of the forts guarding the other entrances to the Cape Fear River that they had the alternative in prospect of surrender or precipitate retreat.

[3] The Secretary of the Navy to Rear Admiral Porter, December 31, 1864.

[4] During this part of the fighting the Army was mainly indebted to the *New Ironsides* "for their success, for, notwithstanding their gallantry, they could not have passed from traverse to traverse without the aid of your guns, which swept the openings between the traverses while the Army advanced from point to point, and the highest compliment I can pay your gunners is to say that when I signaled to the general to know if he was not afraid of an accident from your guns ranging so close to his men, he replied, 'No; that the accuracy of your fire was splendid.' (Rear Admiral Porter to Commodore Radford, January 17, 1865).

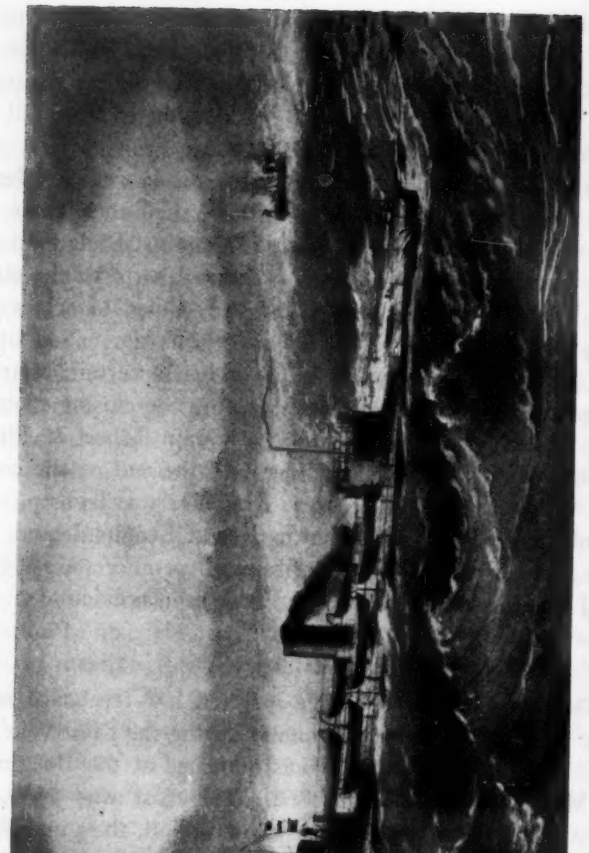
The capture of Fort Fisher and the closing of the port of Wilmington to blockade-runners was a blow from which the Confederacy never recovered. It cut off the last source of supplies for the armies in the field, and severed them from all communication with the outside world.

Two days after the battle, the *New Ironsides* was ordered to proceed to Hampton Roads, where she joined the James River division of the fleet in the final operation against Richmond. The Confederates on several occasions attempted to force the obstructions at Trent's Reach, Virginia, but they failed to achieve their purpose, and though the *New Ironsides* was not called upon to use her guns, her presence in the river had a certain restraining effect upon the enemy's ironclads. During the closing months of the war, the ship was in command of Captain Robert L. Phythian (February 18, 1865), who kept her until the end of the commission. On April 6, 1865, the *New Ironsides* was laid up in ordinary and moored with the monitor fleet at League Island, Pennsylvania. She was destroyed by fire on December 16, 1865. The cause of the disaster is believed to have been accidental.

"Monadnock"

The *Monadnock* was a double-turreted low-freeboard monitor of 3,990 tons built by the government during the Civil War. Her keel was laid in 1862, and she was launched at the Boston Navy Yard, Mass., on March 23, 1864. Her cost was $981,439.45. Wood and iron were used in her construction, the dimensions of the hull being: length, 259′; breadth, 52′ 4″; depth of hold, 12′ 6″; draft, 12′. The propelling machinery was built by Morris, Towne & Co. of Philadelphia, and consisted of twin-screw Ericsson vibrating-lever surface condensing engines of 1,800 horsepower and 27″ stroke, for which steam was supplied by vertical water-tube boilers. She had a bunker capacity for 300 tons of coal. The battery consisted of four 15-inch smooth bore guns, mounted in two circular turrets, behind 10½″ of armor. The sides of the vessel were protected by 7-inch iron, while the deck was covered by two 1-inch plates. There was a conning tower on top of each turret, with a light flying deck between the turrets. Her crew numbered 149 men.

The *Monadnock* was placed in commission at the Boston Navy Yard, Massachusetts, on October 4, 1864, and put to sea on the



U. S. S. "MONADNOCK"

Navy Department Photograph

following day under the command of Captain John M. Berrien. After a brief trial trip, she put into Hampton Roads, where Commander Enoch G. Parrott joined the ship (November 20, 1864). Her orders were to join Rear Admiral Porter's fleet[5] at Beaufort, North Carolina, which was the rendezvous for the expedition fitting out against Fort Fisher and the Wilmington defenses. This was the most famous of the ports of the Confederacy, and during the whole war the scene of many brilliant successes of the blockade-runners and the most strenuous efforts of the blockading squadrons. But nature favored the former, and it was only in December, 1864, when the Navy Department was able to spare enough vessels to ensure the capture of Fort Fisher, that the practice came to an end. Fort Fisher was only one of a number of works guarding the entrances to the Cape Fear River, but it was the principal defense erected by the Confederates. It consisted of a range of isolated batteries mounting twenty-one heavy guns and seventeen other pieces. It was garrisoned by about one thousand men.

On the morning of December 24, 1864, the *Monadnock* went into action with the ironclad division. At less than 1,200 yards from the shore, she opened a heavy fire upon the enemy's works. "The fire of the fort was soon controlled by that of our ships," wrote Commander Parrott,

> and during both attacks was quite feeble; especially so on the second day. I noticed long intervals of silence on the part of the rebels. Most of their guns were abandoned, and the few fired from time to time only loaded after repeated efforts. Their men were often driven away as many as five times before completing the loading. The projectiles from our vessels rained upon the fort, and did, I think, whatever damage shot and shell are capable of doing to sand fortifications.

But the army on shore failed to take advantage of the bombardment, and the attack had to be renewed by the fleet a few weeks later. The position of the *Monadnock* during the action of January 13-15, 1865, was the same as previously. This time the monitor was anchored, and

> here we remained, firing by day and a portion of the night, and taking in ammunition at night, until the capture of the fort and its dependencies. The permanency of position enabled us to obtain and keep a very perfect

[5] This was the largest naval force ever assembled under the Union flag, and included fifty-seven vessels of war.

range. While the ironclads alone were opposed to the fort, the rebels attempted to contend with them, and opened a fire rather severe and obstinate, but less accurate than ours; but their guns, as they successively showed activity, were invariably reduced to silence. We aimed almost wholly at their guns, watching the effect of each shot, and waiting for the smoke to clear away before firing another. As their disabled guns generally remained in place, it was an inconvenience during the latter part of the fight, as the rebels did not fire often enough to show us which were the remaining efficient ones. We saw one of them tumbled over by our fire, and I have no doubt that most of them or their carriages received disabling shots over and over again from the ironclads. Never was a work better prepared for an assault. . . . . At the moment of the assault we had the satisfaction to see that the guns on this face could not be used against our advancing men. . . . . We were witnesses of the splendid fighting of our Army. After our troops had entered the fort, our fire, with that of others, was against a gun on the sea face near the east angle, which had been reversed and which alone of all the guns of Fort Fisher was firing on them rapidly with grape. The ricochet of our shell enfiladed the sea face, which swarmed with rebel musketeers. As it grew dark the gun became silent (we afterwards ascertained it had been disabled) and the flash of muskets along the sea face almost ceased.[6]

The *Monadnock* was struck five times, but the damage was of trifling importance and there were no casualties.

After the capture of Fort Fisher, the *Monadnock* was transferred to the South Atlantic Blockading Squadron, which, under Rear Admiral Dahlgren, was operating before Charleston, but following the evacuation of that city by the Confederates in February, 1865, she was sent to reinforce the naval division in the James River, Virginia. Commander William Ronckendorff joined the ship in Hampton Roads, on March 21, 1865, and after the fall of the Confederate capital, he took the *Monadnock* to Havana, Cuba, where the vessel formed part of squadron detailed to receive the surrender of the ironclad ram *Stonewall*. On the completion of this duty, the *Monadnock* was ordered to Philadelphia, June, 1865.

There the vessel was fitted out for a cruise to the Pacific Station, this distant voyage being planned to "dispose in a great degree of the misrepresentations and prejudices which had been created" against the turreted vessels of the Navy and to vindicate their "navigating power and capability." The *Monadnock* stood down the Delaware River on November 2, 1865, in command of Lieutenant Commander Francis M. Bunce (September 6, 1865), and ac-

[6] Commander Parrott to Rear Admiral Porter (no date).

companied by the *Vanderbilt, Powhatan,* and *Tuscarora* made the voyage according to schedule down the east coast of South America, through the Straits of Magellan, and up the West coast, anchoring in San Francisco Bay on June 22, 1866. She found no weather which seemed to touch the limit of her seagoing capacity[7], and at all times behaved so well at sea as to inspire her officers not only with confidence but with enthusiasm at her performance as a sea boat. The distance run by log was 15,385 nautical miles, the greatest distance covered in twenty-four hours being 195.6 miles. The average speed during the voyage was 6.32 knots. The engines were run at about sixty revolutions per minute. Not a single piece of the spare machinery was used, the engines performing beautifully and being in working order when the ship reached her destination.

The *Monadnock* was laid up in ordinary at Mare Island, California, on June 30, 1866. A few years later, the wooden hull was found badly decayed in many places. Repairs were undertaken by the Continental Iron Works at Vallejo, California, a new iron hull being constructed to replace the old wooden one. Before the ship could be completed, complications arose which caused the government to take possession of her and remove her to the Mare Island Navy Yard, where the work of rebuilding her was continued from 1875 to 1896. The characteristics of the new iron hull were: displacement, 4,005 tons; length, 260′; breadth, 55′ 6″; draft, 14′ 6″. New engines of the horizontal triple-expansion type and four single-ended Scotch boilers were installed. The former were designed to develop 3,000 horsepower, and on trial drove the ship at a speed of twelve knots. The old conning towers

[7] "In a gale off Point Conception, on the coast of California, two successive waves rose which interposed between my eye and the masthead light of the *Monadnock*. Upon inquiry I found that the light was elevated seventy-five feet above the water, my own eye being about twenty-five feet above the sea level. In this sea, according to the testimony of her officers, she was very easy. While it blew the hardest, and the sea was the most violent, she twice parted her tiller ropes in quick succession. Thus, without the use of her rudder. she hove to with the double-screw propellers, lying dry and comfortably in the storm. . . . . The success of the voyage amply vindicates the judgment of the department in undertaking it; and the hopes of the most sanguine "monitor" people are fulfilled in this crucial experiment."—Commodore John Rodgers, commanding the *Vanderbilt,* to the Secretary of the Navy, June 28, 1866.

were removed, and the space between turrets was filled by a superstructure with living quarters for the crew. The armament was also modernized, and consisted of four 10-inch breech-loading rifles in the turrets, with a secondary battery of two 4-inch guns, two 6-pounders, two 3-pounders and seven pieces of smaller caliber. The complement was changed to twenty-six officers and 137 men.

The *Monadnock* was placed in service at the Mare Island Navy Yard, on February 20, 1896, by Captain George W. Sumner, being attached to the Pacific Station. Commander William H. Whiting (June 22, 1897) was in command when the news of the declaration of war against Spain was received. The *Monadnock* was immediately directed to join Commodore Dewey's squadron in Asiatic waters, and her passage across the Pacific Ocean in the summer of 1898 under war conditions was as notable a performance as her former voyage around the South American continent. She reached Manila Bay, Philippine Islands, on August 16, and was detailed to guard duty off the Cavite naval arsenal. Under Commander Henry E. Nichols (January 26, 1899) she joined the *Charleston, Concord* and *Callao* in shelling a detachment of insurgents who were attacking the American garrison in Manila, February 5, 1899. During the Zapote River campaign, the *Monadnock* was anchored off Paranaque, Philippine Islands, as support to the right flank of the Army. She lay within easy range of the Filipino trenches, exchanging shots with the enemy almost daily. Commander Nichols died of sunstroke in June, whereupon the command of the ship devolved upon Lieutenant Commander Alexander McCrackin, who took the *Monadnock* into action on June 10, at Paranaque and again three months later at El Pardo.

During the year 1899, the vessel was engaged in blockade duty off the Island of Cebu, where she was assisted by the gunboats *Calamianes* and *Panay*. Captain John McGowan joined the ship on August 15, 1899, being relieved in the following year by Lieutenant Commander Thomas B. Howard (February 10, 1900), who had temporary charge of the *Monadnock* until the arrival of Captain Edward T. Strong (May 5, 1900). Under Captain Oscar W. Farenholt (December 18, 1900), the monitor was employed in Chinese waters for the protection of the foreign settlements at Hong Kong during the Boxer Rebellion, and a few years

later she visited Shanghai for the same purpose, in command of Captain Asher C. Baker (1904). During the Russo-Japanese war she was stationed in Manila Bay, in connection with the interned Russian vessels there, after which she was sent to Canton, China, on special service. Her commanding officers during the latter part of this cruise were Commander Edwin H. Tillman (1905) and Commander Frederick W. Coffin (December 28, 1905). The ship was laid up in ordinary at Olongapo, Philippine Islands, on March 10, 1909.

In the winter of 1912, the *Monadnock* was recommissioned by Lieutenant Commander Emil P. Svarz (January 31, 1912) as tender to the Asiatic submarine flotilla, in which capacity she continued to serve throughout the World War. Her commanding officers in 1917-18 were Lieutenant Miles P. Refo, Jr. (1917), Lieutenant Herbert K. Fenn (1918), Lieutenant Alfred H. Balsley (August 1, 1918). After the war, the *Monadnock* was laid up in ordinary at the Cavite naval station, March 25, 1919. She was subsequently stricken from the navy list and sold on August 27, 1923.

WHAT PRICE PACIFISM ?

By Clifford Albion Tinker

THERE is a book which was written by a Chinese more than 2,000 years before Christ was born, when all Europe was a wild and trackless wilderness, except for a little fringe of settlements around the rim of the Mediterranean, when the Greeks were just emerging from barbarism, and some thirty-five centuries before this Hemisphere was discovered. This book is on the subject of military warfare. The author's name is S'suma Ch'ien. In it he wrote:

> What, then, can be said for the scholars of our age, blind to all great issues and without appreciation of the relative values, who can only bark out their stale formulas about "virtue" and "civilization," condemning the use of military weapons? They will surely bring our country to impotence and discord and the loss of her rightful heritage, or at the very least they will bring about invasion and sacrifices of territory and general envelopment.

No truer prophecy than this has been handed down to man; 4,000 years of Chinese history prove it; the present chaotic plight of China is its dire fulfillment. History reeks with similar prophecies, with similar pacifism in high places, and with similar direful results. Yet movements are underway which make it apparent that with the whole gamut of written history before us, and the impressive examples of latter-day world experiences still a part of our own memories, we Americans are recoiling from the bogey "armed force."

Witnesseth. With increasing frequency come from our own people accusations that the United States is a military nation, that militarism dominates our government and impregnates our diplomatic relations with nations beyond the seven seas. Indeed, so widespread has this idea become that millions of Americans have united in clubs, societies, associations, and federations to combat this real or fancied thing, militarism, which they conceive to be not only in direct opposition to the spirit of enlightened Christianity, but the rock upon which the Ship of State is swiftly drifting to evident disaster.

Themselves militant, these crusaders for peace have endowed and maintain a centralized, federated headquarters in Washington, under the very shadow of the War Department, which carries on a continuous campaign of press-drenching propaganda against the maintenance of federal armed forces, against the normal movement and employment of those forces, against congressional appropriations for national defense purposes, and the training of civilian soldiery; this together with an adroit system of lobbying on Capitol Hill for measures which have for their ultimate end the advent of pacifism as the prime factor governing our ideals of political thought, domestic and international.

These Americans are undeniably exercising a privilege vouchsafed them by the Constitution, they are breaking no law, they are actually striving for a result that is the hope and prayer of all mature, sane Americans, namely, world peace; but the magnitude of the movement, the complexion of its sponsors, the seriousness of the charges of militarism, the vigor of the attacks on our traditional governmental policies and agencies, and the uncompromising attitude of the leaders of the federation at Washington, challenge immediate attention to the whole subject by those who believe with the great British statesman that the "Constitution of the United States is the greatest instrument ever struck off at a given time by the mind and purpose of man," and that the wisdom of its framers still stands as the guiding beacon of benevolent democracy here and elsewhere.

Among human beings, Americans, on the whole, are the most sentimental; their heartstrings are attuned to the pathetic note in every appeal for aid, whether local, national, or world-wide. They are the good Samaritans of civilization, hence they are the quickest to respond to humanitarian enterprises; goldbrick, "sob-sister" international supplications not excluded. Quick to act, their first impulses, whether sound or impracticable, suddenly become translated into veritable crusades. Howbeit, Americans are also fact-seekers, fact-analysts. The glory of their achievements in industry, in the sciences, in the humanities, in the development of a benevolent type of civilization which, beyond argument, today overlaps in its contributions to human welfare the most extravagant dreams of the disciples of federal paternalism, lies in their ability to face fact, whatever its character, and fight it to a logical conclusion. All social and political movements and innovations

in this country, then, must sooner or later run the gauntlet of searching fact-analysis, must stand on a foundation provided by their fundamental value to the whole people, or fall because of inherent impracticability.

Whether or not these great organizations now attacking the very existence of our governmental armed forces, and banded together in the richly-funded federation known as the National Council for the Prevention of War, can substantiate their attacks and justify their own existence when themselves attacked by fact-seeking investigations gives ground for an honest difference of opinion. At all events, their rapid rise to power and influence reveals how little they have suffered from cold, hard, enthusiasm-killing, fact-delving attention on the part of the general public and its constitutional authorities.

Thus we find that public apathy and federal indifference to the activities of this council and its component boards and associations have resulted in one of the most amazing political moves in the history of constitutional government in this or any other land. Laugh at the futility and absurdity of this move as loudly as you please; it is formidably, vastly serious in that it represents the disciplined but unyielding, and as yet unchallenged, thought of the laity of the militant council just named which, according to the membership claims of its executive officer, constitutes more than one-quarter of the entire population of the country. And this one-quarter of our people, in their own minds engaged in a crusade for the early realization of the millenium by federal enactment, are the very ones we shrink from criticizing, from chiding, and even hesitate to expose to self-revealing, pitiless fact, for they are our mothers, our wives, our sisters, and our sweethearts. They are the members of such organizations as the Council of Women for Home Missions, the National Board of the Young Women's Christian Association, the American Association of University Women, the National League of Women Voters, the National Woman's Christian Temperance Union, and a host of others of national scope and possessed of huge membership.

The political move in question, significantly blanketed as far as publicity was concerned at its birth, is a proposed amendment to the Constitution of the United States, as contained in S. J. Resolution 100, introduced before the Senate of the sixty-ninth Con-

gress on Calendar Day, April 23, 1926, by Lynn J. Frazier, United States Senator from North Dakota. This resolution reads:

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled (two-thirds of each House concurring therein), That the following article is proposed as an amendment to the Constitution when ratified by the legislatures of three-fourths of the several states:

ARTICLE———

SECTION 1. War for any purpose shall be illegal, and neither the United States nor any state, territory, association, or person subject to its jurisdiction shall prepare for, declare, engage in, or carry on war or other armed conflict, expedition, invasion, or undertaking within or without the United States, nor shall any funds be raised, appropriated, or expended for such purpose.

Sec. 2. All provisions of the constitution and of the articles in addition thereto and amendments thereof which are in conflict with or inconsistent with this article are hereby rendered null and void and of no effect.

Sec. 3. The Congress shall have power to enact appropriate legislation to give effect to this article.

This extraordinary resolution was read twice before the Senate without one word of inquiry or protest and then referred to the Committee on the Judiciary. While one wonders what influence and pressure, what mental process, or what profound emotion caused the senator from North Dakota to propose such an amendment to the Constitution, one is at an utter loss to understand how the other senators could remain silent when, on the face of it, their colleague's amendment proposes nothing less than the dissolution of the Federal Union; the abandonment of a national entity founded and erected upon a cornerstone of consecrated unity—life, liberty, and the pursuit of happiness—maintained and developed by toil and sacrifice unutterable, and which, under the favor of the Almighty, is civilization's liveliest hope for the future preservation and expansion of law, order, justice, and freedom in a politically and racially chaotic world.

While it is manifestly unfair to accuse the senator from North Dakota of vote-baiting, to assert that he was carrying out the mandate of the National Council for the Prevention of War, his action is in line with the public demands of that body and its supporting associations. The writer has seen parades of peace-at-any-price advocates on the streets of our large cities where the participants carried banners and transparencies inscribed with the slogan "Outlaw War!" and others reading, "Write Your Con-

gressman to Have Congress Outlaw War." Senator Frazier, as we must believe, of his own free will and initiative, has begun an attack on the Congress and the Constitution which could not be more in accord with the council's program if he were himself its president. Could one imagine the unprecedented folly that would bring about the ratification of this proposed amendment, it has one left-handed virtue; the United States of America, the greatest and most successful exponent of a government of the people, by the people, and for the people that the world has ever seen, would be voted out of existence and not wrecked by civil war. That doubtful virtue, it may be presumed, would be salve enough for a Frazier who otherwise contemplates the dissolution of this God-founded nation as a mere day's work in the Senate.

It cannot be denied that if there are Americans who wish to see their country again plunged into the horrors of war they are among the feeble-minded and insane. But what can be said of the sanity of those who would sacrifice the union in their misguided efforts to keep the American people from ever engaging in a war for the defense of their homes and loved ones; aye, to keep them from defending that liberty for which our fathers laid down their lives and which they left us as a sacred heritage to be passed on without vestige of loss to a single blood-bought precept to millions yet unborn? Yet this is what Senator Frazier proposes; what the peace-possessed council is mightily striving for, and what our mothers, wives, sisters, and sweethearts, of the boards, associations, and federations are earnestly praying for. There is something desperately out of joint here. Were our fathers wrong? Was all the suffering and sacrifice that made and has kept us a nation a useless display of militarism? Was the blood our fathers shed wasted in behalf of a liberty not worth protecting? Is the Constitution a mere infamous excuse for the maintenance of armed forces that it must be emasculated to impotence? How did we get a Constitution so full of blood-thirsty provisions that a Frazier must strike it to the ground?

At the close of the Revolution, the weakness of the Articles of Confederation under which the colonies maintained a semblance of national unity was everywhere discouragingly apparent. The four years of turmoil and political and economic chaos following the joyful victory at Yorktown cried to heaven for a prompt and vigorous remedy. The remedy believed to be the sure and lasting

cure was a "more perfect union." Such a union could be realized only through the will of the sovereign people. Madison took the initiative and had sufficient political sagacity and force of character to persuade the Congress of the hour to call on the States for delegates to an assembly to be held at Annapolis, far enough away from the Congress and the great merchants of New York to insure its deliberations might not be unduly influenced, and a meeting was called for September 11, 1786. So few delegates reported that the assembly was dissolved, but not until an appeal had been made to the states to call a constitutional convention at Philadelphia for the second Monday in May, 1787.

In the interval between these two sessions came Shay's Rebellion in Massachusetts, a circumstance that brought forward the important question of domestic tranquility. Each impoverished commonwealth of the Confederation felt the tangible menace to government which that disturbance brought to light. George Washington, writing to Harry Lee, then in the Congress, hit the keynote of the situation in these words:

> You talk, my good sir, of employing influence to appease the present tumults in Massachusetts. I know not where that influence is to be found, or, if attainable, that it would be a proper remedy for the disorders. *Influence* is not *government*. Let us have one by which our lives, liberties, and properties will be secured, or let us know the worst.

Shay's Rebellion, finally crushed by General Lincoln with a hastily levied army, was an object lesson well heeded, and the Constitution came from the convention with provisions for maintaining forces to guarantee domestic tranquility and the common defense, bulwarks of the Union, all of which Senator Frazier proposes to abandon and thus enable enemies from within and without to wreak their will on a defenseless American people. Moreover, on this question of domestic tranquility rests the Ark of the Covenant between the states and the Nation. Article IV, Section 4, of the Constitution specifies:

> The United States shall guarantee to every state in this union a Republican form of government, and shall protect each of them against invasion, and, on application of the legislature or executive (when the legislature cannot be convened), against domestic violence.

For this guarantee and this protection the several states surrendered to the Federal Government many of their most cherished sovereign rights. And the Congress, of which the senator from

North Dakota is a member, is the recipient of those rights, which constitute the "Powers of Congress" set forth in eighteen subsections in the first article of the Constitution, ten of which are concerned with the "guarantee and protection" promised the states and with the armed force to be employed in keeping the promise and in making the other eight "powers" effective; herein lies all that there is to the Federal Union. *"Influence* is not *government,"* wrote Washington, nor can machinery function without power, and power is force. The judge on the bench decrees incarceration or death, but the majesty of the law is merely the symbol of justice and authority; the judge's sentence is carried out by armed men. Likewise, the "Powers of Congress" are mere empty gestures without the force to make them potent and effective.

When this government, or, more correctly, the recipient Congress, through political chicanery secures the adoption of an amendment to the Constitution which has for its purpose making null and void and of no effect those promises made by the Union to the states in return for surrendered sovereign rights, then those rights must automatically revert to the states concerned. This being done, the Federal Union is defunct. This very thing was discussed and became a closed issue during the constitutional convention. A schism developed in the debates on the question of proportional representation in the Congress by the states, some of the small commonwealths feeling that they were the subject of discrimination by their larger and more populous sisters. In the heat of the controversy, James Wilson suggested separation. A member from Delaware, replying to Wilson, gave a logical course of action on the part of those states whose rights have been surrendered to a Union that repudiates promises given in return, when he said:

> The larger states dare not dissolve the Confederation. If they do, the small ones will find some foreign ally of more honor and good faith, who will take them by the hand and do them justice.

Nor can the states arbitrarily repudiate their engagements with the Union. This issue has also been closed forever; witness the failure of the Ordnance of Nullification passed by the legislature of South Carolina in 1832, and the more decisive failure of the Southern Confederacy.

It ought to be apparent that the "Outlaw War" advocates must see to it that this Frazier amendment is greatly modified if they desire it to become something more than a ridiculous proposal, and if they desire it to become a part of the Constitution upon such terms that the Union may legally survive. For, were it possible to find a sufficient number of spineless, potato-custard legislators in the capitals of three-quarters of the states to ratify the proposed amendment and yet permit the Congress to retain the surrendered state rights or "powers," neither the three-quarters nor the Congress would be able to keep the stiff-spined one-quarter in the Union. Thus the amendment, in spite of its third clause, would in itself be null and void and of no effect, for it would be illegal to enforce it, and were this latter disability waived, it would still be unenforcible without the armed force which it prohibits. It is unthinkable that such a mad-dream, preposterous thing as this Frazier amendment will ever emerge from its pigeon-hole in the Committee on the Judiciary. It is just as unthinkable that the twenty-five or thirty million American women now squarely behind the move to "Outlaw War" will for one instant retain their interest in the Frazier proposal when they understand that its enactment and ratification would mean the breakup of the United States, the end of the Federal Union.

It must be that the Frazier line of attack represents the thought of the extremist element in the peace-at-any-price ranks. There is a less radical section that would stop short of dissolving the Union, but which is determined to do away with armed force in the United States. They desire a government, but they propose to run it to suit themselves. Communists, "I.W.W."s, anarchists, and foreign-born agitators of soviet leanings without a gleam of knowledge of the fundamental principles of our brand of democracy join with the women and the male pacifists supporting the National Council for the Prevention of War in this phase of the campaign. It is an unarmed America that these people seek, for, if unarmed and defenseless, the goal, the real aim of all this agitation, communism, will be the sooner reached. Scan the list and peruse the records and speeches of the leaders comprising the interlocking directorate of the council; it shows a fine rabble of communists and internationalists for our mothers, wives, sisters, and sweethearts to strike hands with.

This pacifist council declares that if the nation disarms that the power of its example will influence other nations to disarm. Here you have the same old word "influence," although no more futile than the expression "power of example." This "power of example" is only powerful when it is the mirror of leadership combining the highest type of courage, fortitude, achievement, and the will to stand four-square to the winds of adversity with knight-errantry not to be denied. An example of weakness, of bowing before the storm, of repudiation and spiritless surrender, wins naught but disgust, ridicule and derision, and invites attack and disaster. As for "influence," it has come to mean that type of angleworm political action which burrows its subterranean way through sloughs of cowardice and reaches those who dare not meet the test of straightforward suffrage at the polls.

Nature abhors weakness and cowardice. Which creature do we applaud, which laugh at, the eagle defending his nest, or the ostrich burying his head in the sand? And are not the bravest the tenderest? As a nation we pity the under-dog, even to rescue—let Cuba testify to this fact—but why must we, as the council demands, volunteer to become under-dogs? What mother desires her boy to be a coward, officially or otherwise? What kind of mother can she be who deliberately seeks legislation to force her boy into the ranks of the under-dogs? Have all our mothers throughout our history been cruel, Godless Amazons, thrusting their offspring on the altar of war? Were our mothers all wrong when they kissed us goodbye and gave us their blessing as we marched away in 1898 or in 1917 to defend our common country? The thought is an insult to their tears and their sainted memory. Then what has possessed our women, some thirty million of them, that they follow a leadership which seeks to sap our manhood?

If the brutal truth must be told, the mother-love of these millions of American women is being played upon to the disregard of their common sense; they are being misinformed, exploited, and made factors in a terrible menace to the future welfare of their own sons. Woman suffrage is still in the spellbinder stage. The newly-made voters, as women have always been, are being turned to by professional religionists, ism-founders, and sob-issue crusaders—men and women—as legitimate recruits for communistic and internationalistic campaigns said to be cures for all the social and economic ills of the world. To win and consolidate the

women's vote, propaganda has been belched forth all over the land that we are a militaristic people, that our alleged huge armaments are being plumed for conquest, and that we are headed straight on the road to war. This is one of the most cruel lies in history, and it is high time that our women knew it.

In the first place, these propagandists for disarmament have abused the word *militarism.* Militarism is not power, it is not force. It is but the system, the *motive,* which would employ power. Organized force in the hands of one nation may constitute militarism, but the same force in the hands of another sort of nation does not constitute militarism. Thus militarism is a thing of the soul. It is hateful to every true American. It is hateful to us because it represents despotic leadership of bloodthirsty character forcing its iron will upon the weak and powerless. But because we hate this militarism, we are not relieved of the responsibility to guard the vital interests of the Nation with whatever moderate measure of military and naval precaution our safety requires. And how moderate are those measures! Today, when the National Council for the Prevention of War, and Senator Frazier, are striving with might and main to reduce us to impotency in the field and on the seas, we have ourselves voluntarily reduced our armed forces almost to that point. We are adjudged to be the richest nation in the world; our power to wage war, when driven to it, is collossal; our man-power is the most intelligent and resourceful among men; yet our Army, computed on the basis of soldiers per thousand inhabitants, is only one and two-tenths. One other country in the world has a ratio as low; little Costa Rica down in Central America. Even Germany, defeated and disarmed, has one and four-tenths soldiers for each thousand inhabitants. Is this militarism in the United States and disarmament in Germany? It is practical disarmament in both countries.

With our Navy it is the same story. We voluntarily entered into disarmament treaties and treaties of *status quo* affecting naval bases in our Far Eastern insular possessions, in which we destroyed a whole fleet of great ships intended to make our naval forces the equal of the combined fleets of Great Britain and Japan. We agreed to observe a ratio of 5-5-3 for ourselves, Great Britain and Japan, respectively. This embraced capital ships and aircraft carriers. In auxiliary ships and lighter fighting craft we

proposed the same ratio; it was not agreeable to our friends, but we have observed that ratio. Great Britain and Japan have not done so. Thus we find that naval ships, cruisers, destroyers, destroyer leaders, and submarines especially, actually projected or laid down if not already launched since the Washington Conference number thirteen for the United States, twenty-five for the British Empire, and ninety-six for Japan. With these facts in mind, can we by any flight of the imagination justly accuse the United States of militarism? The facts make the question ridiculous.

Non-militarism has been our policy all through the years. With the close of the Revolution we reduced our Army to eighty officers and men! In 1788, the year that the Constitution was ratified and that the new Federal Government undertook to put in force the provisions of that Constitution, we raised our Army to 666 officers and men. With this pitiful display of "militarism" the government, in accordance with the preamble of the Constitution, sought to "establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity;" not a simple matter in that day and age. Because we had no Navy we paid tribute to the Barbary pirates for some twenty years.

This policy of unpreparedness has brought us into many preventable wars and rebellions. Yet, after every conflict we have listened to the pacifists and thus are never ready for strife; we have always been taken unawares and have suffered losses accordingly. One wonders if the women supporting the council fully understand what the ratio of casualties among unskilled and ill-provided soldiery is compared to that of trained and well-equipped troops? If they did have this definite knowledge, it seems hardly credible that there would be thirty million women clamoring for total disarmament in this country.

In conclusion, the suggestion is here made that the thirty million women who are, sheep-like, following the pacifist spellbinders, would do well to resolve themselves into a fact-seeking body. They might then learn that it is better for the world at large that we retain the military instincts of a nation wedded to peace. They might learn that the Congress cannot legislate militarism from the hearts of other peoples, and that the best guarantee of world peace is the strong right arms of the United States and

of those powers actuated by the same principles of international justice and goodwill that have characterized our diplomacy ever since the founding of the nation. They might also learn that general disarmament, such as is being legitimately sought at Geneva, if it could be brought about, does not mean the end of wars; armaments, inanimate tools, do not bring about wars, it is the man behind the man behind the gun who starts them and the man with the most effective gun who stops them.

Let these thirty million women contemplate the spectacle of China, with its more than 4,000 years of pacifist civilization; there it is, 400 million strong, yet so weak that it is the victim of huge scale banditry from within and wholesale plucking from without—the result of forty centuries of delusion—what do those poor folk know of domestic tranquility, or of the safeguards of an adequate common defense? Contrast with this ruin, the prosperous, contented, influential solidarity of this land. Did not the ancient S'suma Ch'ien's wisdom, scorned by his own folk, descend upon and direct the founders, builders, and protectors of this nation? And have our leaders so suddenly become legislatively crude and diplomatically witless that these inexperienced women voters must rise up and turn them from the tried and proven policies of the fathers into the paths which history shows to be the roads to ruin?

One more suggestion is advanced; if the thirty million American women now federated with internationalistic leagues cannot find tasks worth their talents in the social and economic development of their own land, they can find an outlet for their energies abroad. Let them dedicate the same amount of time, strength, and money now devoted to the ill-advised efforts of the council in making this country defenseless, to the education of outlander militaristic peoples in the principles of democracy as set forth in the Constitution now under attack, and they will hasten the advent of world peace and the millenium in direct proportion to the effort expended.

A CLOSE CALL

By Rear Admiral (Retired) Albert Gleaves, U. S. Navy

"After all," said an admiral, when receiving congratulations on his promotion, "it is largely a question of luck, when one remembers that in his case the fog always lifted just at the right time, that the helmsman always put the rudder the right way, and the engine room obeyed the right signals."

IN THE summer of 1909 the United States Steamer *St. Louis* was standing down the coast of California on a full speed run while making a passage from San Francisco to Honolulu via the Santa Barbara Channel.

The course lay inshore within easy visibility of the navigational lights. About three o'clock in the morning when off Point Arguello, having sighted all the lights until after passing Piedras Blancas, the weather became hazy, and soon settled into a thick morning fog around the horizon.

It was the practice while coasting to keep the deep sea lead going at intervals even when off soundings, and on this occasion the night orders directed soundings every watch. At 3 A.M. by dead reckoning the ship was off Point Arguello, distant about ten miles, and according to the chart should have been in about 250 fathoms of water. It was somewhat startling therefore when 45 fathoms was reported, then 38, and subsequently irregular soundings until the sounding tube showed 25 fathoms. The ship was slowed and headed out to sea and in an hour was again in deep water.

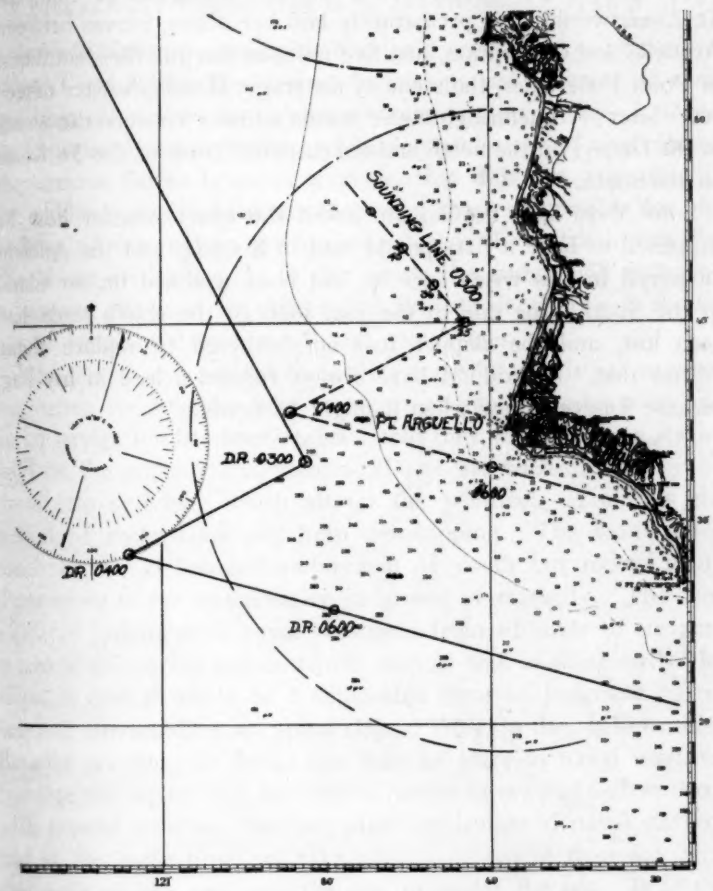
During the sounding, the wire parted carrying with it the last fifty-pound lead. This was rather disconcerting, but the forehanded quartermaster *produced another from his bag.*

At four o'clock the ship was headed back to pick up the land at half speed.

Nature never plays such fantastic tricks as when she is camouflaging sea and earth with fog. On this occasion when dawn broke, the atmosphere apparently was clear. At daylight the masthead lookout reported land ahead, and soon afterwards the brown, sterile cliffs back of Point Conception which mark the entrance to Santa Barbara Channel were in plain sight from the

bridge—so it appeared. Everyone on the bridge saw it—or thought so. The captain remarked to the navigator, "A good landfall."

The natural impulse to resume full speed—twenty knots was checked by an inexplicable intuition not to do it. Lucky decision;



inturning screws are slow to back. Suddenly at six o'clock just as 39 fathoms was reported, the whole scene changed; the sun came up from behind Mt. Tranguillon and shone brightly in a blue cloudless sky; and "as quick as barrels popping at birds," the brown cliffs vanished, but an unmistakably ominous white beach flashed out dead ahead and on both bows only four miles away.

Arguello light house loomed large on the port beam distant two miles. A look astern explained the situation; there lay a fog bank from which the ship had emerged, its grey curtain as sharply defined as that which often hangs on the edge of the Gulf Stream off Hatteras in the winter months.

The part of the coast where, but for the grace of God, the *St. Louis* would have prematurely laid her bones, curves between Arguello and Conception, just five miles as the gull flies, southeast of Point Pedernales, the scene of the tragic Honda disaster fifteen years later; Arguello lighthouse stands midway between the wreck of the *Delphy* on the north and the eastward track of the *St. Louis* on the south.

Some days later the captain asked the quartermaster how he happened to have a fifty-pound lead in his bag, and the Ancient answered in this wise; once he had been wrecked on an island in the South Seas due to the fact that all the ship's leads had been lost, and the skipper had not bothered to replace them. "After that," he said, "I have always carried a lead in my bag, because I never knew when it might be needed."

THE CASE FOR THE CAPITAL SHIP

By Lieutenant Commander G. C. Manning (CC), U. S. Navy

Introduction. So much has been said regarding the efficacy of aircraft and submarines against battleships and so much of what has been allowed to stand uncontroverted is erroneous—founded on superficial acquaintance and inadequate study of the rôle of the various forces in naval warfare, that it is not surprising if the public is unable to understand why those responsible for the policies of our nation are convinced that the battleship is the "backbone of the fleet." In this article the author will endeavor to present the case for the capital ship, to show why it should not be supplanted by aircraft and submarines.

Man has always aspired to do the impossible. It is not surprising, when we consider how recently satisfactory submarine and aerial navigation has been realized, that they should have a strong hold on the popular imagination. There are hazards attached to these two activities which attract the youthful. Youth is the period of enthusiasm and hero worshipping. The world owes much to the ill-founded enthusiasm of youth but many, many times more to the conservative judgment of maturity. The consolidated judgment of naval personnel from admirals to ensigns; aviators, submarine and destroyer men as well as those on battleships, is that it would be a deplorable error of judgment to relinquish our standing in capital ships. Why do they believe this? Because no thing or things can take its place in naval warfare. Because the capital ship can deliver harder blows and deliver them with greater accuracy than any other implement of naval warfare and at the same time can take more punishment than any ship that sails on the sea, over the sea, or under the sea. It is the true heavyweight in the warship class. It carries the power to destroy any enemy which may come against it combined with an ability to defend itself effectively against all comers. Truly a wonderful combination!

Before entering on a discussion of this question on the merit of the facts, let me point out the conclusions that one is forced

to accept, if he accepts the proposition of those who claim that the sun of the capital ship has set. Let us put this down in the form of catechism.

Q. Who directs the operation of the capital ships of the United States Navy?

A. The commissioned officers of the Navy.

Q. Will these same officers direct the handling of these ships and their guns in battle?

A. Yes.

Q. If aircraft destroy these ships in battle will all of these officers be killed?

A. Yes; if one does not lose his life when his ship is sunk in battle it is regarded as a near miracle.

Q. Well, what kind of a bunch of pig-headed fools are the commissioned officers of our Navy to insist on going into battle on ships that will surely be sunk by aircraft? (Same question may be framed substituting "submarines" for "aircraft." Answer is the same in either case).

A. *Quien sabe?*

If you have a suit at law, you consult a lawyer, not a chemist. If your tooth aches, you visit a dentist, not a chiropodist. If you want a hair cut, you go to the barber shop, not to a restaurant. Isn't it reasonable to assume that naval officers know more about naval warfare than anybody else? Can they all be so obtuse, so obstinate as to refuse to see changes in the methods of conducting warfare? Is it possible that a majority of them would prefer going down in battle to saying to the air enthusiast: "You're right, old man?" Naval officers are not stick-in-the-muds. Theirs is a progressive profession, always seeking new and more effective means of naval warfare. Before convicting these several thousand naval officers of incorrigible stupidity, bias and obstinacy, let us weigh the facts with great care.

Offensive Powers. Little need be said regarding the offensive powers of the capital ship because even those who sing, "We can sink the strongest battleship that floats" do not deny the tremendous powers of destruction in its main battery. Our most recent battleships, *Maryland, Colorado,* and *West Virginia,* carry eight 16-inch guns. That does not sound so big, but note. *Each* of these guns can hurl a projectile which weighs a ton a distance of thirty-five miles and do it every forty-five seconds. If the energy in each of these projectiles on issuing from the muzzle of the gun could be applied to lifting it would lift 100,000 tons

(224,000,000 pounds) a distance of one foot. Each of these projectiles is capable of going through eighteen inches of the hardest alloy steel armor plate after traveling five miles through the air. And a battleship with a properly drilled fire control party is capable of getting a good percentage of hits at ranges up to ten miles. At Jutland the ships were hitting each other after the second salvo. In this engagement two salvos each were enough to sink two good British battle cruisers, the *Indefatigable* and the *Queen Mary*. There is no engine of war which can compare in destructive powers with the big gun.

In addition to its battery of big guns, each capital ship carries about a dozen five- or six-inch guns primarily for defense against light craft such as scout cruisers, destroyers, and submarines. These are guns of remarkable accuracy and rapidity of service. It is no stunt to maintain a fire of ten shots per minute from one of them. Their projectiles have ample power to shoot light warships full of holes.

Besides these two batteries of guns, the capital ship has a battery of eight or ten high-angle fire guns for warding off aircraft attack. These guns are five-inch on recent ships, and the guns are capable of being fired at a very rapid rate. Although aircraft enthusiasts have pooh-poohed the efficacy of the anti-aircraft gun, I do not know of a single instance where a bomber has penetrated the barrage of a ship's anti-aircraft battery and dropped his bomb on her. I do not believe that this has ever occurred. It takes a brave man to advance into any kind of a barrage, and the aviator who flies his machine into a barrage of five-inch high explosives is indeed worthy of the designation, "Daring." For it must be borne in mind that the bomber is not a stunting plane. It is not the type of a ship used for exhibition purposes. It does not dive, loop, and spiral at high speed, but sails along on an even keel at a comparatively low speed. It is not a poor target.

Another thing that must not be lost sight of is that each of these three batteries may be operating simultaneously. Each has its own gun crews, its own ammunition supply system and personnel, its own fire control party; each entirely independent of the other. A capital ship may be dumping tons of projectiles with tremendously destructive effect on another capital ship ten miles away, shooting an enemy scout full of holes and making

things lively for a squadron of bombers all at the same time and without impairing the efficiency of any of the guns. What other engine of warfare is capable of such offensive powers?

Defensive Powers. Turning now to defensive powers, let us see if this giant has his heel of Achilles; if he is powerful only if he is not injured. No less authority than Admiral Farragut has said, "The best defense is the well directed fire of your own guns." Anyone who has any knowledge of warfare will add a fervent "Amen" to that statement. And the ability of a capital ship to maintain accurate fire at a rapid rate cannot be disputed. It has therefore the most powerful means of defense in its offensive powers. But let us examine its strictly defensive powers.

In general it may be stated that the capital ship is subjected to three forms of attack. The form of attack, which although the oldest is still considered by many the most effective, is to hit the ship with missiles. This form of attack antedates the invention of gunpowder and guns. The ancient Romans mounted on their warships instruments for hurling stones. A newer form of attack is that of producing an explosion under the water close to the ship. The first recorded instance of this form of attack occurred about a century and a half ago, but only in the last twenty-five years has it constituted a serious menace to the capital ship. The most recent form of attack is that of enveloping the ship in a cloud of poisonous gas, or of exploding a gas shell or bomb within a compartment of the ship containing men. These three are at present the only effective methods of attack against a capital ship. Ramming has been employed in the past with warships propelled by oars and steam, but the ability of the capital ship to destroy the enemy at a great distance, and very quickly, makes it a practical impossibility for a ship to close with a capital ship, much less deliver an effective attack by ramming. This form of attack was used in the World War by auxiliary craft, notably destroyers against submarines, and may be used by such in the future, but it is not a probable form of attack against the capital ship.

The purpose of any attack is to destroy the offensive and defensive powers of the enemy. In the case of naval warfare this purpose is fulfilled if (a), a ship is sunk, or, (b), such a portion of the operating personnel of the ship is rendered incapable of offensive or defensive efforts that the ship may be captured.

Prior to the days of ships of iron and steel the latter was the means employed. Owing to the natural buoyancy of the wood of which the ships were built, it was almost an impossibility to sink them, so that the effort was to render the personnel *hors de combat* by gunfire. With the introduction of iron and steel for ship construction a change took place due in part to the fact that the material of which the ship was made would not float in water. The introduction of armor to protect the personnel operating the battery and machinery made it difficult to put them out of action. The purpose of attack was, therefore, changed from the killing and wounding of the men on board to the sinking of the ship.

It is not the intention of this paper to prove that the capital ship is impregnable, for such is not the case. Any of the above forms of attack *under favorable conditions* may put a capital ship out of action. It is desired to show the tremendous powers of resistance of this type of warship, powers not possessed by any other class. It is these unusual powers of resistance, coupled with the power of delivering an equally powerful attack, which makes the capital ship "The backbone of the fleet." The capital ship has remained the mainstay of the fleet because nothing can take its place. It will remain the fleet's mainstay so long as this is true. It has changed widely in nature and appearance during the past centuries and future conditions in warfare will bring about other changes, but we shall always have capital ships.

The protective features of the capital ship may be classified briefly according to the forms of attack. Protection against direct hits of missiles dates back to the Civil War. The materials used and their distribution has changed, but the fundamental theory of this form of protection, that is, to keep out the projectile, to prevent its penetrating the vitals of the ship, remains the same. At the present time this protection is provided by a vertical belt of armor on the sides of the ship, and flat armor on two decks. To protect the capital ship against underwater attack there is incorporated in its structure what is known as a "protective layer" on each side in way of the machinery spaces and magazines. In other words, protection against underwater attack is accomplished by means of the sub-division of the ship into water-tight compartments. Protection against poisonous gas attack is accomplished by gas masks, protective clothing, and forced ventilation.

Protection Against Direct Impact of Missiles. Until recently attack by direct impact of missiles meant just one thing—gunfire. Today we must include in this classification direct hits by aircraft bombs. Aircraft bombs striking the water close to the ship are of the nature of underwater attack and are discussed under this heading. The use of iron or steel armor plate to protect metal ships against gunfire dates from the Civil War. One purpose of the side armor is to prevent holes being made in the ship near its waterline—between "wind and water" as they used to say in the days of sailing ships. When a projectile hits the water, it either ricochets or sinks so rapidly that the entire underwater portion of the ship need not be armored. The depth to which the armor extends below the water is based on the results of carefully planned and observed experimental firings to determine the maximum depth at which a projectile will break through the skin of the ship. It is important that no holes be made in the ship between "wind and water," because such holes will admit water to the ship and cause a loss of buoyancy and stability. It is such damage which causes the loss of most capital ships.

The side armor and deck armor also serve to protect the boilers and engines, powder magazines, and the men stationed there, against the destructive effects of gunfire. Deck armor has recently become more important because of an increase in the range of naval battles. The longer the range, the more the gun must be elevated and the sharper will be the angle at which the projectile falls, since the angle of fall is just a little greater than the angle at which the gun was elevated to fire it. The deck armor on recent ships is thicker than on earlier ones. In addition, recent ships have two armored decks while earlier ships had only one. The higher deck is designed to cause the projectile to explode; the second to withstand the impact of the fragments of the bursted shell. The "vitals" of the ship are below the lower armored deck. The smoke stacks have armor protection extending up to the highest deck. This is done to insure that the smoke and gases of combustion will not be directed inside the ship by a shell striking in this vicinity. In addition, there are fitted in all air intakes and smoke stacks armor gratings at the level of the armored decks. These armor gratings keep out projectiles but permit air passage in much the same way as screens exclude flies and mosquitoes but let the breeze blow through.

The net result of these arrangements on a modern capital ship is that the propelling apparatus (boilers and engines), magazines, vitals of the ship, are encased in armor of sufficient thickness to protect them against gunfire under what are considered average battle conditions. The unarmored portions of the ship comprise the spaces in which the officers and men sleep and eat. *This part of the ship could be entirely destroyed without vital injury to the ship.* It would be inconvenient to have no place to sleep or no galley to cook food in after the battle, but most people will be thankful enough to be living not to grumble greatly about inconveniences.

The armored decks constitute the principal protection against direct hits by aircraft bombs, because these fall vertically and consequently do not strike the side armor. The adequacy of such protection therefore reduces itself to providing armored decks which are strong enough to exclude the effects of such explosion. Aircraft bombs may be divided into two classes; the first, those containing a large explosive charge, and the second, those which are built like the projectile fired by a gun. The former have a comparatively thin shell; the bulk of their weight being the explosive charge they carry. They depend for their efficacy upon the action of explosion when they strike. This is the usual type. Recently a new type of bomb, built like a projectile fired from a gun has been developed. This type has a thick shell, a specially prepared point and a relatively small charge of explosive. It is designed to secure penetration by crashing through the deck just as a rifle bullet crashes through a plank. The action of these two types of bombs is sufficiently different to discuss them separately.

Anyone who has seen an aircraft bomb dropped on shore is impressed by the size of the hole it digs, and the way it scatters dirt. Their first thought is—"My God! What wouldn't that do to a ship!" And yet, to the best of my knowledge and belief, *no aircraft bomb has ever penetrated the armored deck of any ship.* The reason is not difficult once the governing principle is understood. *All forces are dissipated in the direction of least resistance.* This principle applies to explosive forces as well as to other forces. Water runs down hill *because that is the direction of least resistance.* If we connect a large wire and a small wire to an electric battery the greater amount of current flows through the large wire *because it has less resistance.* When the aircraft bomb strikes

the surface of the earth it penetrates into the ground a short distance before it explodes. It lifts the dirt above it *because it is easier to lift this dirt than to push the rest of the world down out of its path.* When a bomb strikes the armored deck of a ship, it explodes right there. *The direction of greatest resistance is against the ship.* All other directions are directions of less resistance, and the direction of least resistance is straight up. This is the explanation of the fact that direct hits by aircraft do not penetrate to the vitals of the ship. It is working at a big disadvantage. Only a very small part of the energy of explosion is directed against the armored deck, and this is not sufficient to break through it.

A thick-walled bomb depends upon its energy of motion to crash through the armored deck. Its ability to do this depends upon its speed. The speed depends upon the height from which it was dropped and the resistance of the air. The greater the height the greater the speed, and the greater the speed the greater the resistance. There is, therefore, a limit to the speed which an article falling freely can attain. We are not concerned with this limit, however, because it involves heights too great for a bomber to reach or to do any accurate bomb dropping. The speed with which a bomb dropped from a height of 10,000 feet (nearly two miles) strikes the surface is about 700 feet per second. The velocity with which a projectile fired from a gun strikes the ship is very much higher. And the striking energy depends upon the *square* of the speed. That is, if we have two projectiles of the same weight and size and we drop one from an airplane at 10,000 feet and fire the other from a gun at 60,000 feet (a good battle range), so that the striking speed of the gun-fired projectile is *twice* that of the dropped projectile, the gun-fired shell strikes a blow that is *four* times as severe as that of the bomb, and consequently has a much better chance of penetrating the ship. Therefore, if a ship has sufficient deck armor to exclude projectiles fired from a gun, no aircraft bombs will pierce that deck.

Protection Against Underwater Attack. Underwater attack consists of the production of an explosion below the surface of the water and close to the underwater portion of the ship. While the technology of underwater explosions, in common with explosions in general, is extremely involved, the guiding principle is comparatively simple. *The energy of an explosion dissipates itself in the*

direction of least resistance. Applying this principle to an underwater explosion close to the ship's side, the directions of least resistance are against the ship and straight up. If the explosion occurs at the surface of the water, its energy will almost all go up. The deeper below the surface the explosion occurs, the more of its energy will be directed against the ship. If an explosion occurs under the bottom of a ship, there is only one direction of minimum resistance—straight up, against the ship. It is extremely difficult to produce an explosion under the bottom of a ship and this occurs very seldom.

Underwater explosions may be produced by submarine mine, torpedo, or aircraft bomb dropped close to the ship's side. There is no difference in the effect produced by an underwater explosion due to its origin. That produced by the recent aircraft bomb is no different in nature from that produced by the old torpedo or the older mine. The effect produced depends upon the amount and kind of explosive used, and how close to the ship's side the explosion occurs. The energy of explosion always has a tendency to vent itself up and if it occurs even at a comparatively moderate distance from the ship it vents itself through the surface of the water before exerting any considerable force against the ship. During the World War, patrol vessels dropped hundreds of depth charges over their sterns without injury to themselves because in the time it took the depth charge to reach the set depth they advanced beyond the danger zone. The horizontal range of an underwater explosion is surprisingly small when we consider its intensity.

In order to protect the vitals of the capital ship from direct impact of missiles we have placed them below two armored decks and inside of a side armor belt. In order to protect them against underwater attack we have placed them inboard of compartments which can be destroyed without seriously impairing either the buoyancy or stability of the ship. The only large compartments, those approaching the size of holds on a cargo ship, are those containing the propelling machinery. These are located in the middle of the ship with seven partitions between them and the water. The boiler rooms which are comparatively small since they contain only one boiler each, are outboard of the machinery compartments on each side. In order that they may be flooded, the damaging force must break through six partitions. Experiments with under-

water explosions against structures like the *California* have indicated that this system of protection is adequate against underwater attack.

In plain language, this is what happens when a torpedo, mine, or aircraft bomb explodes alongside a capital ship at a reasonable depth. The force of the explosion tears apart the plates forming the outer skin of the ship and the gases generated by the explosion flow into the empty compartment immediately inside. In doing this they expand and their pressure falls and consequently their ability to destroy the ship is reduced. The gases next attack the group of compartments, three in depth, which are filled with oil and so built and braced as to offer a large resistance to destruction. The energy spent in destroying each one of these reduces the remaining energy of the gases. The number of tanks required therefore depends upon the energy of the gases generated by the explosion, a matter for experimental determination. Inboard of the oil tanks is a row of empty compartments to provide an expansion space for the gases if they destroy the boundaries of all the oil tanks. Their expansion into these compartments will further reduce their already greatly reduced pressure to such a point that the outer boundary of the boiler room remains intact. *The effects of the explosion are kept out of the vitals of the ship.*

Protection Against Attack by Poisonous Gases. Attack by poisonous gases and smokes may be delivered by dropped aircraft bombs, gun-fired projectiles or sprayed from aircraft. In attacks of the first two classes the projectiles are of the thin-walled type rather than of the armor-piercing type, in order to deliver the maximum quantity of gas on the attacked ship. The danger of such attack to a ship lies largely in the fact that in battle many spaces are closed air tight to prevent a spread of flooding in event of underwater damage, and such spaces must be supplied with air drawn in from the outside by powerful ventilating fans. That deadly concentrations of gases may be produced in certain compartments of the ship or entirely surround the ship is unquestionably true, but it does not follow from this that the ship will necessarily be put out of action. Gas attack against land forces did not put these forces out of action in the World War although they increased the hazards of fighting. A ship can better resist a gas attack than can troops on shore.

In the first place, naval actions are relatively short, usually a matter of a few hours, while land engagements last days and sometimes weeks and months. Due to this fact the gases used in naval warfare are the most volatile gases, which diffuse readily into the surrounding air. The ship can rid itself of charges of these gases which are taken in by changing the air in the compartments affected, that is, by their ventilating fans. It is not particularly difficult for a ship to run out of a gas infested area. A capital ship at full speed (21 knots) goes four-tenths of a land mile in a minute. In ten minutes she could run out of a gas cloud of four-mile radius. Such a gas cloud would cover an area of *fifty* square miles. Some gas cloud! It would take tons of gas to produce a cloud of that extent. When the attack was delivered, the crew would have to put on gas masks just as soldiers do in event of a gas attack on shore. But, whereas soldiers may have to keep their masks on for hours, the sailor could take his off after about half an hour as a maximum.

War Experience. The cases of capital ships sunk by gunfire in the World War are so numerous that it is difficult to know where to begin. To mention two of the more important engagements, we have the German battle cruiser *Blucher* at Dogger Bank and the British battle cruisers *Indefatigable* and *Queen Mary* at Jutland. In this last-named, the only major fleet action of the World War, all of the capital ships lost were destroyed by gunfire although several of them were torpedoed more than once. No capital ship having underwater protection similar to the *California* has ever been sunk by submarine, destroyer, or aircraft.

The oft-repeated assertion of the air enthusiast, "We can sink the biggest battleship that floats," is based on bombing tests conducted against some helpless pre-dreadnaughts to study the effect of such attack. The helpless hulks attacked included the *New Jersey* and *Virginia*, built about 1904, before the days of the "submarine menace" or aircraft, and the old German ship *Ostfriesland*. These ships had none of the underwater protection of the present-day capital ship and very little deck protection. They were built when the battle range for fleet engagements was about 6,000 yards and the danger of plunging fire was very remote. Consequently their principal protection was in their side armor. No naval officer has ever maintained that these ships had adequate protection against aircraft or torpedo attack.

On the other side of the picture we have the tests on the post-Jutland battleship *Washington* which had to be scrapped in accordance with the Limitation of Armaments Treaty. These tests were conducted with as near laboratory precision as conditions permitted, and while for obvious reasons the details of these tests were never published, the results were. The official report of these tests was that they indicated that the present system of protection for capital ships gave them greater powers of resistance against aircraft and torpedo attack than against gunfire. Any ship built can be destroyed, but a capital ship has a much better chance of destroying a capital ship than a flock of airplanes or any other type of ship.

The only actual instance under war conditions which I have been able to find where a capital ship has been seriously attacked by aircraft occurred during the Gallipoli campaign in the World War. The Turkish ship *Sultan Selim II* (ex-*Goeben*), a German-built battle cruiser dating from 1907 ran aground on one excursion down the Dardanelles. She remained aground for a week, during which she was attacked by the entire British and French air force, who dropped approximately 500 bombs and made no less than twenty-five direct hits. This attack did not even interfere with salvage operations. The ship was lightened and returned to Constantinople under her own power.

Conclusions. It is a thorough knowledge of all of these facts which makes the Navy retain its faith in the capital ship. There is no thing, or things, which can take its place. No engine of warfare can compare with it in either offensive or defensive powers. It has the power to destroy any attacker and adequate passive means of protection against all known means of attack. The experience of centuries of naval warfare teaches us that that nation which has a preponderance in capital ships rules the sea, and it is so well known as hardly to warrant the saying, that that nation which controls the sea, controls the world.

The characteristics of the capital ship which give it its supremacy are not of a temporary nature but inherent in this type of ship, and it is difficult to see how future developments can change it. The most effective way to fight capital ships is by means of capital ships. Sea power of nations is measured in terms of capital ships.

NEPTUNUS REX

By Lieutenant Commander Glenn F. Howell, U. S. Navy

A VOLUME devoted to the origin and growth of customs, habits, and ceremonies at sea would prove pleasant reading for all modern sailors who love the sea, be they naval or mercantile. Many old practices disappeared with the advent of steam and were allowed to lapse into disuse as modern day business methods superseded old-time seagoing ways.

But during these great changes Neptune's visits to all craft entering his domain persist both in the Navy and in the merchant marine. This lathering, shaving, and ducking performance with its accompanying license seems to have originated many years ago.

Careri in his *Voyage Round the World* under date of 1697 gives us a description of the horseplay which occurred in Spanish ships in his time. He says that a canopy was erected so as to form a court of signs. Under this canopy sailors, assuming the functions of president and judges, seated themselves, "being clad," says the writer, "after a ridiculous manner." It is unfortunate that descriptions of the costumes were not recorded. One would like to learn what Spanish sailors of the seventeenth century would consider ridiculous in dress. The proceeding was that of a mock court. First the captain was brought before the judges and rather smartly dealt with. Then followed the chief pilot, the under pilot, the master, mate, and other officers of the ship, and after they had been tried the passengers were arraigned. "The clerk," says the author, "read every man's indictment, and then the judges passed sentence of death, which was immediately bought off with money, chocolate, sugar, biscuit, flesh, sweetmeats, wine, and the like. The best of it was that he who did not pay immediately or give good security was laid on with a rope's end at the least sign given by the President Tarpaulin. I was told a passenger was once killed aboard a galleon by keelhauling him, for no words of authority can check or persuade a whole ship's crew." These sports, it appears, lasted till nightfall, after which the sailors divided the fines among themselves, had a brief carouse, and then returned to their duty.

It was also the custom of the Portuguese to allow their sailors to celebrate crossing the line. A Capuchin missionary in an ac-

count of a voyage to the Congo in 1666 relates an account of this practice. He states that those persons on board who had never crossed the equator were expected by the sailors to present them either with a piece of money or with something to eat or drink. "No man is excused," writes the missionary, "not even the Capuchins, of whom they take beads or similar articles, which they expose for sale; what they yield is given to say masses for the souls in purgatory." Any man refusing to pay his tax was carried before such another court as that described by Careri. A seaman dressed in a long robe sat in a chair and acted as judge, and his sentence was immediately executed. The usual judgment was that the culprit should be ducked in the sea. The father explains how this was done.

> The person condemned is tied fast with a rope and the other end of it run through a pulley at the yardarm, by which he is hoisted up and then let run amain three times under water, and there seldom fails to be one or another who gives the rest diversion.

The Italians indulged in the same kind of skylarking. Merolla relates that it was the custom of the Italian sailors to fine those who were crossing the equator for the first time. If any man refused to pay, then without regard to his title, dignity, or position he was seized, sent aloft in a trice, and mercilessly ducked. This writer assures us that there was a church supported by these fines.

The importation of Neptune, clothed regally and bearing a trident, hailing the ship and stepping over the bow, is probably of British origin. There apparently exists no record of this custom in ancient foreign sea tales. It is not believed that either British or American sailors ever employed the strenuous custom of ducking their victim from the yardarm, although they made matters unpleasant enough for him by smearing his face with a filthy, frothing mixture, scraping it off with the half of an iron cask hoop until the face was bleeding, and then plunging the wretch backwards into a tub or tank full of water.

Yet there was something exquisitely humorous about all this to our grandfathers and to the old time Britishers. Horseplay like this they enjoyed and appreciated, just as we love it now. In the lengthy cruises ordinarily involved in crossing the equator, it usually forms a welcome break in the monotony of the voyage to turn the ship over for one day to Neptune and his court.

TO TELL THE SOLAR TIME, LONGITUDE AND LATITUDE BY THE STARS OF THE GREAT BEAR, OF THE SOUTHERN CROSS OR OF CASSIOPEIA'S CHAIR

By Alan S. Hawkesworth, *F. R. S. A.*

FOR the northern hemisphere consider the pole star as the center of an imaginary clockface with 12 above, and 6 below in the usual fashion. And the two "pointers" of the great bear, or "dipper" as the hour hand of the said clock. Read the time indicated, and add the number of months and fraction of a month that have elapsed since January 1. Double this sum and subtract from a constant which will be 52¼ when the said doubled sum is greater than 28¼, or from 28¼ when it lies between 4¼ and 28¼, or from 4¼ when it is less than this. The result will be the true solar time counted from midnight with the P.M. hours from 12 to 24, in astronomical fashion.

For example; on September 27 the two pointers are at 7 upon the imaginary clockface. The dipper being below, and to the left of the pole star. The elapsed months are $8\frac{27}{30}=8.9$; which added to 7 gives 15.9. Doubled and subtracted from 52.25, gives 20.45 hours. So that the solar time will be 27 minutes past eight in the evening.

The explanation is as follows: The heavens, with the two pointers, are revolving counter-clockwise once in twenty-four hours, and once in twelve months. So that the pointers are moving in the reverse direction to the true hour hand and only half as fast. And each additional hour space, upon our imaginary circum-polar clockface, will subtract either two solar hours, or one month. So that had the pointers reading, in the above example, been say 8, then it might have been either two hours earlier namely 6 hr. 27m. P.M. Or else we might have been observing a month earlier on August 27, at 8 hr. 27m. P.M.

Write A for the reading on the imaginary clockface by the pointers. And let B equal the elapsed months and fraction since

January 1 while 2K is the solar time on 1 January of the culmination of say the outermost of the two pointers; namely *beta ursae majoris;* whereat the pointers will be approximately vertical (lacking but 2°) at 12 upon our imaginary clockface. At midnight 2K hours earlier they must have been at K upon that clockface, measured clockwise. And to have reached the observed position A in the elapsed B months, they must have travelled over (K—A), or (12+K—A), or (24+K—A) hour-spaces counter clockwise, each space equal to two solar hours. But of the stated spaces, B are due to the elapsed B months. So that the solar time will, in general, be either 2 (12+K—A—B) = 24+2K—2 (A+B) or else 2 (24+K—A—B)=48+2K—2 (A+B) according to whether 2 (A+B) is less, or greater than (24+2K). Except that shortly after midnight at the beginning of the year when 2 (A+B) is less than 2K the pointers will have travelled counterclockwise merely over (K—A) spaces and the solar time thus be 2K—2 (A+B).

The retrograde sequence will be as follows: When 2 (A+B) is less than 2K we will have A.M. time, from 2K to (12+2K) P.M. time, from (12+2K) to (24+2K) A.M. time again, from (24+2K) to (36+2K) P.M. time once more, and above (36+2K) once more A.M. time.

At Washington in 1925 the culmination or 2K value of *beta ursae majoris,* the outermost of the two pointers, is at 4 hr. 15 m. 16.239 sec. in the early morning of January 1. So that our three fixed constants for the northern hemisphere will be 4.252675, 28.252675 and 52.252675 respectively. And in future years, as the 2K value increases at the rate of 3.63 sec. yearly, the correction in these three constants can be made accordingly.

So that as 2 (A+B) rises from a minimum of zero to 4.25 we have A.M. time, from 4.25 to 16.25 P.M. time, from 16.25 to 28.25 A.M. time, from 28.25 to 40.25 P.M. time, and finally from 40.25 to a possible maximum for 2 (A+B) of 48 we have A.M. time. The 48 hour retrograde cycle beginning and ending with 4 hr. 15 m. 16.239 sec. AM.

Since the longitude difference in degrees, minutes and seconds, west or east between any two points on the earth's surface is ever 15 times their simultaneous time differences plus or minus in hours, minutes, and seconds castaways in an open boat, with no instruments, save a watch set to any known meridian, can, with

the eye alone, roughly but quite certainly determine their position. Even a momentary glimpse at any instant during the night of the easily recognized great bear or (as we will later show) of the southern cross or Cassiopeia's chair will suffice and thus the ghastly and long-drawn-out agony of aimless drifting be avoided.

With a sextant for precise slope measurement we can calculate more exactly as follows. Let C=30 A be written for the exact angle in degrees, measured clockwise from 12, of the line joining the north pole to the outermost of the pointers, namely *beta ursae majoris*. Obtained by measuring the elevation above the horizon of the two stars (*"alpha"* and *"beta"*) of the pointers, calculating therefrom the inclination of the pointers and then adding 1°51′59.1″

Write D for the number of days and fraction elapsed since our initial or zero point, the culmination of *beta ursae majoris* on January 1 at $4^{hr}\ 15^{m}\ 16.239^{sec}$ A.M. There are 366.242198769 solar days in the sidereal year and thus each day corresponds to .9829555°. And .9829555 D will be the degrees corresponding to the elapsed days and fraction, or making a distinction between leap, and non-leap year the corresponding degrees will be .9809264 D for leap years. And .9836066 D for non-leap years also 30° equal an hour space, of two elapsed solar hours, upon our imaginary circum-polar clockface. So that $\frac{C + .9829555\ D}{30}$ will replace the (A+B) of our simpler formula and the precise solar time will now be $\left[\text{Constant} - \frac{C + .9829555\ D}{15}\right]$ with 52.252675 or 28.252675 or 4.252675 as the constant. The test for which of the three constants to employ being that the answer, the solar time, be positive yet less than 24.

As an example; again take on September 27, 1925 the pointers reading about 7 on the clockface. The exact clockwise angle from 12 of the line joining the Pole to *beta ursae majoris*, or C, being 212° 13′ 50.8533″=212.2307953°. Since the initial 2K or zero point on January 1, 269 full days, and some fraction of a day, have elapsed. And by our simpler formula this fraction is 20.45 — 4.252675 = 16.197324 hrs. = .67489 days. Multiplying D = 269.67489 by .9829555 gives 265.0783° which added to 212.2307953 makes 477.309095361°. Dividing this by 15 gives 31.8206063574 hours. Which subtracted from 52.252675 leaves 20 hr. 25 m.

55.425 sec. as the solar time or 8 hr. 25 m. 55.425 sec. P.M. Recalculating with this more accurate fractional day of 16.1794 hours =.674 days and multiplying D=269.674 by .9836 the non-leap year factor the final true solar time works out as 8 hr. 25 m. 13.4888 sec. P.M.

Cross-checking; the *Star Tables* give the culmination of *beta ursae majoris* on September 27, 1925, as occurring at 10 hr. 33 m. 40.4 sec. A.M. And when the line joining *beta* with the Pole, measured clockwise from 12 is 212.2307953° it has travelled counter-clockwise from 12 over 147.7692046° and taken 9 hr. 51 m. 04.608 sec. in so doing. Giving us a final time of 20 hr. 24 m. 45.008 sec. which is 28.48 sec. less than our other calculation, a difference doubtless due to lunar perturbations.

Conversely; at any date later than March 5 then

$$28.252675-\frac{.9829555\ D;}{15}$$

or if previous to March 5, $\quad 4.252675-\frac{.9829555\ D;}{15}$

will give the hour of culmination of *beta ursae majoris* on that date, D days after $4^{hr}\ 15^{m}\ 16.239^{sec}$ A.M. on January 1 since C here is zero.

To calculate the longitude in the northern hemisphere; with M hour for the known time by radio or chronometer of any given meridian; the difference from that meridian, in degrees, will be

$$15\ M-15\left[52.252675-\frac{C+.9829555\ D}{15}\right]$$

$$=15\ M-[783.79015-C-.9829555\ D]$$

Or we may have to use in place of 783.79015 either 423.79015 or 63.79015 the test for the correct constant being that the bracketted portion of our second equation must be both positive and less than 360°. Whereupon if the said bracketted portion positive and less than 360° is also less than 15 M the resulting degrees of longitude will have a plus sign, and we will be west of our given meridian. While if it be more, the resulting minus sign shows that we are east.

Turning now to the southern hemisphere, again let us picture an imaginary clockface around the south pole with 12 above and 6 below in usual fashion. And as the hour hand of our clockface let us take the two stars forming the upright of the southern

cross namely *alpha* and *gamma crucis,* the line through these two stars passing almost exactly through the south pole. Curiously, the polar distances and positions of *alpha* and *gamma crucis* are almost identical with those of *alpha* and *beta ursae majoris* respectively.

If precision be desired take a line joining the south pole with the nearer star of the upright, namely *alpha crucis.* Or on the other hand if the exact location of the south pole be too difficult then the exact inclination and direction of the upright can be taken for our hour reading. But in this case 17m. = .3 hr. must be added to the true 2K value in our calculation. The clockwise from 12 angle of the upright being 4° 17′ 23.07″ less than C, the clockwise from 12 angle of the line joining *alpha crucis* with the south pole.

The southern heavens with the cross revolve clockwise once in 24 hours and once in 12 months. So that the upright turns in the same direction as a true hour hand but only half as fast. And each additional hour space upon our imaginary circum-polar clockface adds either two solar hours or one elapsed month.

Again write A for the hour reading of the upright upon our clockface and B for the months and fraction elapsed since January 1, while 2K is again the time of culmination, on January 1 of *alpha crucis;* whereat the southern cross is roughly vertical (within 4° 17′·23″) and its upright indicates 12 upon the clockface. At midnight, 2K hours earlier, the upright must have been at the (12—K) hour space and having reached A in the elapsed B months must have travelled clockwise over (K+A—12) hour spaces should A exceed 12—K, and also K+A exceed B. Or else over (K+A) spaces, should (12—K) exceed A, and also (K+A) exceed B or lastly over (K+A+12) spaces if (K+A) be less than B. Since in every case B spaces of the said A spaces travelled over clockwise, each one equal to two solar hours, must be due to the elapsed B months since January 1. Wherefore the solar time must be either 2 (K+A—B)=2K+2 (A—B) or else 2 (K+A—B+12)=2K+24+2 (A—B) except in the early morning hours at the beginning of the year when A exceeds 12—K and (K+A) exceeds B when the solar time will be 2K—24+2 (A—B). The test for which of the three formulas to employ being that the total, the solar time,

must be both positive and less than 24. In all cases being counted from midnight with 12 to 24 representing the P. M. hours.

In the Star Tables the culmination of *alpha crucis* on January 1 is at 5 h. 40 m. 08.14 sec. A.M. So that 5.668927 will be our 2K value and one of our three constants. The other two being 29.668927; and —18.331072, this latter negative constant being used only in the early morning hours at the beginning of the year when the upright indicates from 9⅛ to 12 upon the clockface. Our formula for the southern hemisphere will thus be as follows: Taking as the hour hand upon our imaginary clockface the upright of the southern cross read the indicated hour and subtract from this the number of months and fraction thereof elapsed time since 1 January, double this difference and if it be positive add it to, or if it be negative, subtract it from either 30 or 6. Except in the very early hours at the beginning of the year when the said doubled difference will be greater than +18 and must be added to —18. The result will be the solar time counted from midnight with 12 to 24 for the P. M. hours and further with the 17 m.=.3 hr. addition made, to correct for the upright's inclination.

The 48 hour cycle, beginning and ending with 2K = 5 hr. 40 m. 08.14 sec., will be as follows: With 2 (A—B) less than the maximum of 24 down to 18 we have A. M. time, below 18 down to 6, P. M. time, below 6 but greater than —₇ 6, A. M. time again, less than — 6, but more than — 18, P. M. time again, and finally, from 2 (A —B) = — 18 = down to a minimum of — 24, A.M. time once more.

For example; on July 9 the two stars of the upright lie horizontally to the right of the south pole, and are thus at 3 upon our imaginary clockface. Since January 1, 6.3 months have passed. So that 2(A — B) = — 6.6. Adding 30 as the constant gives 23.4 hr., or 11 hr. 24 m. P.M. as the solar time.

Or should we wish for greater precision. As before; let D days be the number of days and fraction thereof that have passed since our zero, or initial point, the culmination of *alpha crucis* on January 1 at 5.668927 hr. Multiply D by .9829555 to obtain equivalent degrees. Or, should we wish to distinguish between leap-years and non-leap-years, then .9809264 D will be for the leap-years and .9836066 D for the non-leap-years. Subtract the said equivalent degrees from C, the angle in degrees measured

clockwise from 12 of the line joining *alpha crucis* to the south pole. Divide this difference by 15 and if the result be negative subtract it from either 29.668927, or from 5.668927, or if it be positive add it to either 5.668927 or to — 18.331072. The proper constant to employ being that one which will make our answer, the solar time, both positive and less than 24. So that, in short, the solar time in the southern hemisphere will be

$$\left[\frac{C - .9829555\,D}{15} + \text{Constant}\right]$$

For example taking the night of July 9; with the upright lying horizontally to the right of the south pole so that the clockwise angle from 12 of the line joining *alpha crucis* with the south pole by measurement is 96° 00′ 12.129″. Since January 1, 189 full days have elapsed with a fraction that by our simpler formula is (23.4 — 5.668927) = 17.73107 hr. = .7388 days. Multiplying D = 189.7388 by .9829555 gives 186.548° so that the solar time is

$$\frac{96.002813 - 186.548}{15} + 29.668927 = 23.63258 \text{ hr.} = 23 \text{ hr.}$$

37 m. 57.29 sec. = 11 hr. 37 m. 57.29 sec. P.M. Recalculating with the more accurate fractional day .7484855 and multiplying D = 189.7484855 by the non-leap-year factor .9836 the final time works out as 11 hr. 37 m. 35.69 sec. P.M.

Cross-checking; by the *Star Tables* the culmination of *alpha crucis* on July 9 takes place at 17 hr. 13 m. 05.68 sec., and when the line joining *alpha crucis* to the south pole has traveled clockwise over 96° 00′ 10.129″ then 6 hr. 24 m. 00.675 sec. have passed giving us 23 hr. 37 m. .06.355 sec. as the time.

In like manner; the hour of culmination of *alpha crucis* at any date D days after the initial point of 5 hr. 40 m. 08.14 sec. A.M. on January 1, will be: Constant — $\frac{.9829555\,D}{15}$; since C is here zero. That is, neglecting the small but incalculable perturbations in the earth's movements due to the moon.

For determination of the longitude let M hour be the known time by chronometer, radio or an accurate watch for any given meridian with C and D as above. Then the degrees of longitude will be 15 M — [C—.982955 D + constant] which constant will be 445.033916; or 85.033916; or — 274.966083. The criterion for which of these three constants to use being that it must

make the portion of the equation within brackets positive yet less than 360°. And if said bracketed portion is positive yet less than 360° and is also less than 15 M, we will be west of our chosen meridian whose time is M. While if it be more, then we are east as the resulting minus sign shows.

Any prominent star such as Sirius or Vega or Canopus could be similarly employed to give us the solar time and longitude by simply substituting in the respective formula that star's 2K value namely, the precise hour of its culmination on January 1, and, as we will later show, it is indifferent whether we insert the said 2K in the northern or southern set; either, or both, should give the same results.

Were it desirable we might correct 2K in each case for its minute daily increment. Since the common rate of yearly increase at the beginning of 1925 was + 3.6345 sec.; in 1926, + 3.6339 sec.; in 1927, + 3.6332 sec. and so on. So that during 1925 the daily increment was + .00995 sec. = .00002764 hr., which multiplied by D and added would give a corrected 2K for that date, involving an identical slight increase in the calculated solar time and longitude. Yet the irregularities in the earth's movements due to the moon would, no doubt, swamp such a tiny increase and render its accuracy illusory.

In countries on or near the equator, the poles are on the horizon so that the great bear and southern cross will be beneath the horizon for half the time. And rotating in opposite directions at the same speed they must twice daily be at identical points upon their respective imaginary clockfaces. Namely at A=11.64593694 and at A = 5.64593694 the cross thus rising and setting at the equator, 1 hr. 25 min. later than the great bear. If A_1 be written for the hour space indicated by the pointers at any instant and A_2 for that simultaneously indicated by the upright then $A_1 + A_2 = 11.2918738$ save when A_1 or A_2 falls between 11.6549 and 12, when $A_1 + A_2 = 23.2918738$.

During the first half of the year both the pointers and the cross will be below the horizon at the equator only during daylight hours. And in the latter half of the year only in the autumn months around September will both be below the horizon for the major portion of the night. In which case we can turn to Cassiopeia's chair and employ for our hour hand *gamma*, the star forming the middle peak of the W, the 2K value of which is

18.130583. So that if we take as our hour hand upon the circumpolar clockface a line through *gamma Cassiopeiae* and the north pole, read the indicated hour, add the number of elapsed months and fraction since the zero, or 2K value, on January 1, double this sum and subtract it from 18.13 or from 42.13 or from 66.13 we will again have the solar time. And since *gamma Cassiopeiae* will ever be 6.94 hour spaces, or 13.9 solar hours, later than *beta ursae majoris* it will, in nearly all cases, be plainly visible when the great bear is hidden.

The longitude equation for *gamma Cassiopeiae* will of course be 15 M — [991.95875 — C — .9836066 D] with .9809264 D substituted for .9836 D in leap-years. And with 631.95875 or 271.95875 as the alternative constants in place of 991.95875.

In all the foregoing the clockwise angle from 12 of the pointers, or of the upright which we will call C_o may be calculated from the measured elevation by sextant of their two stars above the horizon. For in the northern hemisphere with E as the elevation by sextant of *beta ursae majoris* above the northern horizon and F as that of *alpha ursae majoris* while 5° 22′ 34″ is their interstellar distance whose Cosec is 10.67313 and Log Cosec 1.0282921. Then when *beta ursae majoris* is in culmination and C thus zero E — F = 5° 22′ 23.685″; and C_o = 358° 08′ 00.9″. Similarly with *beta* directly beneath the pole so that C = 180°, E — F = 0 — 5° 22′ 23.685″ and C_o = 178° 08′ 00.9″. While with C_o = 0 or 180°; and the pointers vertical E — F = ± 5° 22′ 34″ and C = 1° 51′ 59.1″; or 181° 51′ 59.1″. When C = 90° or 270° E — F = ± 0° 10′ 29.424″ and C_o = 88° 08′ 00.9″ or 268° 08′ 00.9″. While with the pointers horizontal and C_o = 90° or 270°, E = F and C = 91° 51′ 59.1″ or 271° 51′ 59.1″. And in all other cases Cos C_o = 10.67313 Sin (E — F) or Log Cos C_o = Log Sin (E — F) + 1.0282921. Which will be a positive cosine in the first or fourth quadrant when E exceeds F, but a negative cosine in the second or third quadrant when E is less than F, and E — F ever lying between ± 5° 22′ 34″. Whereupon C, the clockwise angle from 12 of the line joining *beta ursae majoris* to the pole, from which we calculate solar time and longitude will be given by C = (C_o + 1° 51′ 59″). As a cross-check, when the latitude L is known; Cos C_o = 1.82513 Sin (E — L) or Log Cos C_o = Log Sin (E — L) + 0.2612897884, where again the sign of Cos C depends upon whether E is more or less than L.

For example; with the pointers around 8 in the third quadrant on the circumpolar clock-face let the sextant reading for the elevation of *beta* be E = 21° 35′ 00″ and that for *alpha* be F = 24° 18′ 00″. So that E — F = — 2° 43′ 00″, a negative angle, whose Log Sin is $\bar{2}$.6757510. Adding 1.0282921 gives $\bar{1}$.7040431; the Log Cos of (59° 36′ 38″ + 180°) = 239° 36′ 38″ as C_o, the clockwise angle from 12 of the pointers, making C = 241° 28′ 37.1″ as the angle of the line joining *beta ursae majoris* to the pole employed in the time and longitude determinations.

In like manner, in the southern hemisphere where 6° 01′ 03″ is the interstellar distance between *gamma* and *alpha crucis* whose Cosec is 9.539052 and Log Cosec 0.9795052, if E be the measured elevation above the southern horizon of *gamma crucis* and F that of *alpha* then when *alpha crucis* is in culmination or is directly beneath the south pole and C thus zero or 180°; then E — F = ± 6° 00′ 02.09″ and C_o the clockwise angle from 12 of the upright is 355° 42′ 37″ or 175° 42′ 37″. A vertical upright with C_o zero or 180° gives E — F = ± 6° 01′ 08″. And C = 4° 17′ 23″ or 184° 17′ 23″. When C = 90° or 270° and thus F the elevation of *alpha crucis,* the same as that of the pole, or L the latitude; E — F = ± 0° 26′ 57.43″ and C_o = 85° 42′ 37″ or 265° 42′ 37″. While a horizontal upright with C_o = 90° or 270°, makes E = F and C = 94° 17′ 23.07″ or 274° 17′ 23.07″. In all other cases C_o the clockwise angle from 12 of the upright will be given by Cos C_o = 9.539052 Sin (E — F) or Log Cos C_o = Log Sin (E — F) + 0.9795052. Where again Cos C_o will be positive in the first or fourth quadrant when E exceeds F but negative in the second or third quadrant when E is less than F while E — F ever lies between ± 6° 01′ 03″. Whereupon C the clockwise angle from 12 of the line joining *alpha crucis* to the south pole, which we have chosen to determine time and longitude will be given by C = (C_o + 4° 17′ 23.07″).

For example; with the upright around 2 on the imaginary clock-face in the first quadrant let the sextant reading for the elevation of *gamma crucis* be E = 58° 15′ 00″ while that for *alpha crucis* is F = 55° 35′ 00″ so that E — F = +2° 40′ 00″, a positive angle; whose Log Sin is $\bar{2}$.6676893. Adding 0.9795052 gives $\bar{1}$.6471945 the Log Cos of 63° 39′ 10.6″ as C_o the clockwise from 12 angle of the upright, making C = 67° 56′ 33.67″ as the clockwise angle from 12 of the line joining *alpha crucis* to the south pole; wherewith we determine time and longitude.

And again, as a cross-check, with known latitude L; Cos C_o = 1.8210552 Sin (E — L); or Log Cos C_o = Log Sin (E — L) + 0.2603231, with the sign of Cos C_o determined by that of (E — L). If we wish to employ *gamma Cassiopeiae* for time and longitude then with G as the measured elevation of *gamma Cassiopeiae*, P that of polaris and L the known latitude of C the clock wise angle from 12 of the line joining *gamma Cassiopeiae* to the north pole is given by Log Cos C = Log Sin (G — P) + $\bar{1}$.67987712796 = Log Sin (G — L) + $\bar{1}$.69475223.

Finally; we can also obtain our latitude from the same sextant measurements at any moment during the night of the elevations of the same two stars of the pointers or upright. A matter of importance in the southern hemisphere, where no outstanding bright star is near the pole, and which would be also useful in the northern hemisphere whenever polaris is obscured but the pointers visible.

In the northern hemisphere let L be the desired north latitude and, as before, let E be the measured elevation by sextant of *beta ursae majoris* and F that of *alpha* while C_o is the clockwise angle from 12 of the pointers. Then when *beta* is in culmination E — F = + 5° 22′ 23.685″, and L = E + 33° 13′ 25.78″ but when *beta ursae majoris* is directly beneath the pole, then E — F = — 5° 22′ 23.685″ and L = E + 33° 13′ 25.78″. On the other hand alpha in culmination gives us L = F — 27° 51′ 09.44″ and with *alpha* directly beneath the pole L = F + 27° 51′ 09.44″ and with the pointers horizontal so that E = F, and C_o = 90° or 270°; L = E ± 1° 01′ 21.01″. In all other cases

$$L = E - \text{Sin}^1 [.5479 \text{ Cos } (C_o + 1° 51′ 59.1″)].$$

Similarly, in the southern hemisphere with L for the desired latitude south E for the elevation by sextant of *gamma crucis* and F for that of *alpha crucis* and C_o the clockwise angle from 12 of the upright when *gamma crucis* is in culmination E — F = + 6° 00′ 02.09″ and L = E — 33° 18′ 26.97″. But with *gamma* directly beneath the south pole E — F = — 6° 00′ 02.09″ and L = E + 33° 18′ 26.97″. With *alpha crucis* in culmination L = F — 27° 19′ 02.52″. But with *alpha* directly beneath the pole L = F + 27° 19′ 02.52″ and a horizontal upright with C_o = 90° or 270°, and E = F, will give us L = E ± 1° 43′ 36.48″. In all other cases

$$L = E - \text{Sin}^{-1} [.549132 \text{ Cos } (C_o + 3° 08′ 44.7″)].$$

And note; when Cos (C_o + 1° 51′ 59.1″) in the northern hemisphere or Cos (C_o + 3° 08′ 44.7″) in the southern are negative cosines of angles in the second or third quadrants that portion of the equation between the brackets thereby becomes negative and is thus added to E to obtain L.

For example; in the northern hemisphere with the pointers around 8 on the clockface let the measured elevation by sextant of *beta ursae majoris* be E = 21° 35′ 00″ and that of *alpha* be F = 24° 18′ 00″ as before, so that E — F = — 2° 43′ 00″. And thus C_o = 239° 36′ 38″ and C = 241° 28′ 37.1″. A negative cosine in the third quadrant whose Log is $\bar{1}$.678984252. Adding $\bar{1}$.7387102116, the Log of .5479, the sine of the polar distance of *beta ursae majoris* gives us $\bar{1}$.4176944636, the Log Sin of the negative angle 15° 10′ 01.385″, which added, being negative to E = 21° 35′ 00″ gives us 36° 45′ 01.385″ north latitude.

Similarly in the southern hemisphere with the upright around 2 on the clockface again let the elevation of *gamma crucis* be 58° 15′ 00″ = E and that of *alpha crucis* be F = 55° 35′ 00″, so that E — F = + 2° 40′ 00″ a positive angle and C_o thus 63° 39′ 10.6″ making C the clockwise angle from 12 of the line joining *alpha crucis* to the south pole 67° 56′ 33.67″ while that of the line joining *gamma crucis* to the pole is 66° 47′ 55.3″ whose Log Cos is $\bar{1}$.595455277 in the first quadrant. Adding $\bar{1}$.7396769, the Log of .549 the sine of the polar distance of *gamma crucis* gives us $\bar{1}$.335132177, the Log Sin of 12° 29′ 38.47″, a positive angle which subtracted from E = 58° 15′ 00″ gives us 45° 45′ 21.53″ south latitude.

Furthermore; the foregoing formulas are also true for negative elevations of the poles and are thus available in the tropics for cross-checking the exact latitude on both poles. Since in latitude L south, say, the north pole must be L below the horizon even as the south pole is L above, thus a simultaneous measurement by sextant of E_n and F_n the respective elevations of *beta* and *alpha ursae majoris;* and of E_s and F_s the respective elevations of *gamma* and *alpha crucis* must give identical values in their several formulas, for L_n and L_s save that the northern L_n will be minus, and the southern L_s plus. And conversely, of course, were we north of the equator. In all cases if C_n be written for the clockwise angle from 12 of the pointers and C_s for that of the upright at the same moment then $C_n + C_s$ = 332° 36′ 00.209″ save when

C_n and C_s each exceed that amount when their sum will be 692° 36′ 00.209″ or 360° greater.

And finally; our simultaneous sextant measurements on the pointers and upright will also permit a fourfold cross-check on the time and longitude determinations, since, first, the 2K, or culmination value on January 1, for any star must be the same on both poles. While, secondly, a great circle through either pole and the star—say *beta ursae majoris* or *alpha crucis*—must thereby pass through the other pole. Hence the 2K can be inserted in either the northern or the southern formulas and will give identical results. For if C_1 be written for the clockwise angle from 12, in the northern hemisphere, of the line joining *beta ursae majoris* to the north pole, and $A_1 = \frac{C_1}{30}$ for its hour reading on the northern clock-face. While C_3 is the clockwise angle from 12 of the line joining the same star, *beta ursae majoris,* to the south pole; with $A_3 = \frac{C_3}{30}$ for its hour reading on the southern clock-face and $2K_1$ is the culmination value true for both poles, then $C_1 + C_3 = 360°$ and $A_1 + A_3 = 12$. So that $24 + 2K_1 - 2(A_1 + B) = 24 + 2K_1 - 2(12 - A_3 + B) = 2K_1 + 2(A_3 - B)$, and similarly for the longitude formulas.

Or again; let C_2 be the clockwise angle from 12 of the line joining *alpha crucis* to the south pole; with $A_2 = \frac{C_2}{30}$ for its hour reading on the southern clock-face, and C_4 be the clockwise angle from 12 of the line joining the same *alpha crucis* to the north pole; with $A_4 = \frac{C_4}{30}$ for its hour reading on the northern clock-face. $2K_2$ is the common culmination value on both poles. Then $2K_2 + 2(A_2 - B) = 2K_2 + 2(12 - A_4 - B) = 24 + 2K_2 - 2(A_4 + B)$, and similarly for the longitude formulas.

To sum up; by sextant measurements of the elevations of but two stars—*beta* and *alpha ursae majoris,* or *gamma* and *alpha crucis*—at any instant during the night, we can immediately and quite simply calculate the precise solar time, latitude, and longitude; and that, too, with no risk of any "personal equation" error in estimating the exact moment of culmination such as is inseparable from a noon observation of the sun.

U. S. N. A. [1918] - 1926

By Lieutenant J. J. Hughes, U. S. Navy

MANY officers criticize the Naval Academy for shortcomings of which it is no longer guilty and, when a particular case is brought to their attention, admit that they had taken for granted that everything here had remained as it was when they were midshipmen. From the end of our war with Spain until April, 1917, battleships and cruisers were more than the backbone and eyes of the fleet; they were the fleet itself. Light vessels such as destroyers and submarines were few and relatively insignificant. Aviation was just beginning. Naturally, midshipmen of those days were educated for service in the then existing types, most of which had practically identical fire-control systems, boilers, and reciprocating engines. Although the course at Annapolis was altered from time to time to keep it abreast of progress, no radical innovations were introduced. From that state of affairs the idea arose that the Naval Academy was unduly conservative and that its training lagged behind the requirements of the Navy. To show that such is not the case is the purpose of this article.

Today the complaint is often heard that American colleges do not equip their graduates either to gain a livelihood or to face the difficulties of modern existence. One of the explanations offered for this condition is that too many courses are elective and that in order to win a diploma the student need only accumulate the necessary credits. The latter are given for each and every subject, the number awarded depending upon its relative importance. Cheer leading or direct-by-mail advertising might be worth but two, whereas English literature would doubtless net a great many more. Yet, an undergraduate can progress steadily towards his degree through a hodge-podge of studies which in no way constitutes the balanced ideal of a liberal education. From the foregoing error and confusion, the Naval Academy by its very nature is happily free. Its mission is

> To mould the material received into educated gentlemen, thoroughly indoctrinated with honor, uprightness and truth, with practical rather than

academic minds, with thorough loyalty to country, with a ground-work of educational fundamentals upon which experience afloat may build the finished naval officer. . . . .

The late war marked a definite break in the history of this institution—the end of one period and the beginning of another. The classes of 1918, '19, '20 and the upper half of '21 were graduated in three years which meant that much material had to be either cut down or eliminated. Semi-annual examinations were abandoned along with the review month which had preceded them, thus increasing the time available for advanced work. If there ever had been any frills, which is extremely doubtful, they were discarded under the strain and duress of war. In 1917 and 1918, the number of destroyers and other light craft in commission was enormously increased, keels were laid for several electric-drive battleships, director firing became standard and naval material and practices commenced to assume their present variation and complexity. Accordingly, when the four-year course was resumed with the lower half of '21, the pre-war schedule of instruction and division of time did not come back with it.

In 1925, in recognition of its importance to the Navy, aviation was accorded a prominent place in the curriculum of the Naval Academy and three months were added to the course to accommodate it. Room had already been made elsewhere by raising the entrance requirements which saved for advanced work time previously devoted to high school subjects.

As the seven years since the Armistice have been not only important but also representative ones for the Naval Academy, it is proposed to set down the changes and improvements for each department in as much detail as space will permit.

Executive. The organization and infantry drills of the regiment of midshipmen have been altered to conform to the latest army regulations. The blue service uniforms, overcoats and caps are now the same as officers' except for insignia and can be "converted" upon graduation. The ugly khaki working clothes have given place to undress whites. The midshipmen present a better appearance whether in ranks or out.

Without the slightest relaxation of discipline, they now enjoy privileges which were formerly unheard of. Members of all classes may smoke in their rooms and the word "tendency" has merely its dictionary meaning. To mention a couple of instances in which this department has been broad minded of late: pool

tables have been installed in Recreation Hall, card playing is permitted and recently a chess club was formed which already boasts of more than forty members several of whom are really strong players. On the other hand, two watch officers are always on duty in Bancroft Hall and the regulations are enforced with unremitting vigilance. The twelve commissioned officers who have charge of the battalions and companies are in their offices every morning and midshipmen are not only encouraged to consult them but actually do so frequently and concerning all conceivable topics. In this way, close contact is maintained between the fleet and the regiment. The mission of the executive department is not so much the enforcement of discipline as the inculcation of leadership.

In order to foster a proper respect for rank without any of the evils of hazing, the old "rates" such as youngster stairs, lovers' lane, etc., have been established by official order. The small area on the seaward side of Bancroft Hall lying between the two new wings has been made into a park which is reserved for the exclusive use of midshipmen and according to unofficial custom the only guests they may introduce therein are their own fathers. Leave and liberty are granted far more generously. The academic year has been arranged so as to permit leave during the Christmas holidays in addition to the regular September period. Since many have homes too far from Annapolis to take advantage of the extra ten days, the Academy is kept open under holiday routine and those who remain for their own convenience are freed from restriction as far as is compatible with interior discipline and entertainment is especially provided for them. Any who feel themselves behind in their academic work are encouraged to stay and profit from the coaching given by selected instructors. Extra tutoring is offered, not merely at this time but throughout the academic year, twice a week in all departments. Attendance is strictly voluntary.

"Bilgers" cannot re-enter with the incoming fourth class before the first of September. Since 1923 when this policy was adopted and the new men kept together, without being influenced other than by officers, drills during "plebe summer" have been excellent, morale has been high and a keen spirit of emulation has been developed. At least once a week, the new class hears a lecture by one of the older officers on some naval topic which encourages their interest in the service as a whole.

Seamanship and Flight Tactics. This course now begins the middle of second class year and continues until the final summer aviation training has been completed, which is equivalent to two academic years whereas it formerly required but one. Midshipmen are taught communications more thoroughly than before including the reception of messages both by blinker and buzzer. They are grounded in tactical definitions and simple evolutions, their class room work being supplemented by the actual handling of submarine chasers. One month of first class year is assigned to elementary strategy and tactics; the examination for which consists of an estimate of the situation followed by writing the orders derived therefrom. They study aviation subjects connected with flight tactics, such as aviation history, aerology, aircraft communications, and aviation scouting. This is rounded out by flying in the seaplanes attached to the Naval Academy the midshipmen performing the duties of second pilot, navigator, radio operator, and mechanic.

Another important topic which receives far more attention than heretofore is leadership. Granting that it is intangible and that its theoretical treatment is by no means a method of developing leaders, yet such instruction may stimulate thought and stir to vigorous life instincts which would otherwise remain latent. Accordingly, a series of winter drill periods are devoted to it. The textbook used was compiled from material submitted by officers competing for a Naval Institute prize and is a condensed volume of advice and service experience.

Ordnance and Gunnery. Textbooks and equipment have been kept up to date. New subjects which have been added to the course include airplane bombing, aviation ordnance and gunnery, and mines. The main battery fire-control installation is identical with that of a modern battleship with directorscope, target bearing transmitter, and Ford range keeper. The Vickers director system has been applied to the broadside guns in the south end of the Armory. One of the stabilized director sights now being fitted on destroyers is available for exhibition purposes, although not yet set up. All fire-control periscopes and instruments are so rigged that the conditions of drill resemble those of battle as closely as possible.

The spotting gallery has been improved by laying a miniature railway track on which a tiny electrically propelled battleship runs back and forth on different courses. This is more realistic than

having the target vessel bob up suddenly at changing ranges. Anti-aircraft spotting is simulated by suspending a small airplane from the highest rafters and placing at various distances from it circular pieces of tin painted white and fixed on rods which can be rotated. When turned sideways the disks are invisible, but when one of them is moved through an angle of ninety degrees, it looks very much like the shell-burst which it represents.

Enough four-inch guns have been set up in the enlarged gun shed to afford all midshipmen plenty of practice in bore-sighting and in taking apart and re-assembling breech mechanisms. This is a better method of teaching than having a group hear a talk and then watch a gunner's mate go through the motions. These have also been equipped with dotter gear at which the different crews compete in pointing and training. Ten naval landing guns, Mark XI, with periscope sights, are now in the armory and their workings are explained during every drill period. They are being substituted for the old field guns in spring artillery drills.

In connection with target practice on the rifle range, a marine officer lectures on land warfare and employs a company of marines to demonstrate the use of tracer bullets, a Stokes mortar, and hand grenades. Gas drill is also given. A shooting gallery, built in the basement of Bancroft Hall for pistol and small-bore rifle practice, is kept busy during the winter months.

Navigation. This starts with second class academic year and continues until graduation, giving four terms in place of the former three. The ground covered is much the same as before except that it is done more painstakingly and the conditions which confront the navigator on board ship are simulated very closely in practical exercises and examinations. For instance, the first class has just completed a "cruise" around the world on the *Trenton* during which they used great circle sailing, crossed the 180th meridian and the magnetic equator, entered different ports and laid courses through various channels. Chart problems are frequently assigned such as a cruiser coming into Hampton Roads and anchoring in a certain berth. The Honda disaster with its lesson concerning radio bearings has been carefully studied.

The scope of the following subjects has been enlarged: aviation navigation, surveying, and tides. Drills include practice with the Battenberg indicator, universal drafting machine, chart catalogs, and notices to mariners.

In 1923 a correspondence course in navigation was inaugurated for young officers. The mission selected was to endeavor to keep them interested and tide over the period preceding their assignment to duty as navigators. It attracted considerable attention in the fleet, was particularly helpful to those who were preparing for examination for promotion, and at one time had an enrollment of 150.

Engineering and Aeronautics. The new subjects taught in this department are: theory of flight as covered by the *Pensacola Ground School Manual;* aircraft structure and rigging—a study of nomenclature, materials employed in construction, overhaul, and assembly of heavier-than-air craft; and aircraft engines including mechanical parts, carburetion, lubrication, cooling, and ignition systems, and the most common faults and remedies.

The treatment of thermodynamics is more thorough than formerly and has special reference to the action of gases in dirigibles and other lighter-than-air craft, the number of cubic feet of hydrogen or helium required to lift a given weight, etc.

Practical problems are continually featured, representing all phases of marine engineering, for example computing the amount of cooling surface needed in parallel and counter-flow condensers, steam flow in turbines, and temperature and pressure through nozzles.

Mathematics. In 1919, engineers' handbooks with their short cuts and helpful tables were introduced and midshipmen were required to purchase polyphase slide rules and become proficient in their use. That they have not taken altogether kindly to them since was shown by a recent test which found several "unsatisfactory" in the skill necessary to manipulate them. For these comparatively simple tools, log-log slide rules are about to be substituted. Although more complicated, they are extremely handy in certain engineering calculations. The fourth class now scrapes an acquaintance with "math" in September when they are given a special review instead of waiting for the fateful beginning of the regular academic year. This breaks them in gradually rather than at one jump. Their work has been speeded up so that they take up calculus the second term which enables them as third classmen to study mechanics during the latter half of that year.

Completing the old course in two years frees the second class for the study of engineering mathematics which covers actual engineering problems encountered in other departments and is ar-

ranged so as to create the requisite association between theoretical instruction and practical work later on.

Electrical Engineering and Physics. The present-day midshipman enters this department as a "plebe" and spends his first year on inorganic chemistry with frequent laboratory experiments and lectures regarding its relation to the needs of the Navy, i.e., water testing, gas analysis, and explosives. The treatment of physics, which occupies the second year, is far more advanced than heretofore and includes the elements of thermodynamics, problems on the flight of projectiles, the theory of the torpedo gyroscope, the gyro-compass, and stabilizers for ships.

The radio course has been extensively enlarged, and covers, besides simple spark sets, aviation radio sets, the use of vacuum tubes in transmission and reception, and the radio telephone. A great deal more time is allotted to alternating-current on account of its present importance afloat. The study of it starts with the theory of alternating current generators and simple circuits and progresses into that of synchronous motors, transformers, polyphase currents, and induction motors with the application of the last mentioned to the electric drive.

Methods of teaching have been standardized. Conferences for instructors are held weekly to go over difficult parts of coming work and insure that they will be thoroughly explained to the midshipmen. These discussions are not perfunctory and generally last from thirty minutes to two hours.

Drills are preceded by talks and practical demonstrations so that the midshipmen have a better understanding of how to connect leads and hook up circuits before turning-to and after they have done so the increased laboratory equipment gives every man a chance to work with his own hands instead of remaining a more or less interested spectator.

English. Less emphasis is placed upon the study of literature and more upon composition. The forms which receive most attention are: the letter, social and official; and the naval report which ranges in subject matter from a damaged catboat to a fleet engagement.

The new course in modern European history consists of a comprehensive textbook, supplemented by lectures, some of them by historians of national reputation and others by men of affairs who are authorities on the countries studied. The aim is not only to vitalize the study of history but to give each midshipman such a

knowledge of national ideals and international problems as will fit him to be an intelligent and tactful representative of America and Americanism in every port he may visit.

The interest taken in writing is best illustrated by the existence of the Trident Society, founded in 1923, which publishes a quarterly magazine, most of the material for which is contributed by the regiment. At the request of the Society, a series of lectures on the short story were delivered during the past winter by an English instructor well qualified for the task. Despite their being given during recreation hours and simply for those who wished to attend, the average audience numbered more than ninety. This same organization has already produced *Anchors Aweigh,* a volume of verse, and has in hand *The Book of Navy Songs,* which will be off the press about November 15.

Modern Languages. Fundamental principles are stressed throughout, so that however late in life an officer may be called upon to utilize his knowledge, he will have a solid foundation on which to build. The textbooks in use are modern and practical. The course occupies three academic years and consists of approximately 200 recitations. Henceforth, it will be taken by the fourth, third, and first classes, which puts the inevitable gap in second class year and sends graduates to sea with what they have learned fresh in their minds.

Athletics. A new baseball diamond and grandstand have been constructed at Lawrence Field. The ground in front of the Post-Graduate School has been graded and prepared for track events. Worden Field is now reserved for lacrosse and soccer. A number of out-door handball and basketball courts have been laid out; the former alongside the gymnasium, the latter on the seaward terrace of Bancroft Hall. Flood lights have been erected around the edges of all playing fields, which illuminate them so brightly that short winter days no longer interfere with practice. A new swimming pool has been completed which is housed in a separate building. The dimensions of the tank are 150 feet by 60 feet, with a depth of 10 feet throughout, and seats have been installed for 2,500 spectators. The old pool has been retained for instruction purposes. Eight bowling alleys have been built in the basement of Bancroft Hall.

The Naval Academy now meets other colleges in boxing, soccer, and bowling in addition to the sports in which it formerly competed. Each class and each company has a team in

football, baseball, basketball, lacrosse, soccer, tennis, and handball, not to mention its race boat crew, knockabout sailors, and track men. The entire system is carefully supervised with coaching and training. Thus midshipmen benefit by going out for any branch they choose. Hundreds play football in the autumn, other hundreds lacrosse and baseball in the spring. Since there is room for all and a place for everybody, there is hardly a man in the regiment who is not out for at least one sport and in most cases for two or more. All this is in addition to the regular physical training which has always been a part of the course.

Yet there is no tendency to permit success in athletics to affect study. Those "unsat" are barred from all participation therein. No midshipman not in good standing can represent the Academy and none are allowed to engage in sport to the detriment of their service careers.

Owing to the enormous expansion of this department, the old organization became inadequate. Accordingly, its head was given the title of *Director of Athletics* and made a member of the Academic Board. Assistants for each branch were ordered to report to him for additional duty and have, subject to his supervision, complete charge of the sport to which assigned. The same principle has been extended to all activities so that midshipmen come in contact with officers much more than they once did and meet them on the common ground of a congenial occupation. The former acquire greater poise and a better understanding of the needs of the Navy, the latter gain a deeper insight into the minds of those who are momentarily their pupils but who will eventually be their shipmates.

Entrance Requirements. From 1845 to 1921, there was practically no change in the entrance requirements of the Naval Academy which comprised examinations in spelling, English grammar, geography, history, arithmetic, algebra, and plane geometry. When established they were sufficiently high, but as the years went by they became a handicap, because they exacted only a grammar school foundation to meet the demands of an ever growing technical college course.

In 1921, they had to be increased in order to make available for advanced subjects time previously spent in furnishing the ground work which should have been acquired before entrance. Since then they have been improved step by step until the system of admission is now as follows.

If he passes a brief substantiating examination in mathematics and English, a candidate may be accepted by certificate. This must state either that he is a regular student in good standing at an accredited college and taking a course of which the entrance requirements are not less than those of the Naval Academy, or that he has graduated from a recognized preparatory school or public high school and shown proficiency in the required subjects. A careful account is kept of the Naval Academy records of those admitted in this manner and the past performance of students coming from any institution influences the Academic Board in considering its certificates.

To be eligible for admission, an applicant must have had three years of mathematics, three of English, and one of physics. He is also required to have spent one year on history and one on advanced mathematics, science, or languages. Subjects such as stenography, agriculture and animal husbandry are not given credit.

Those who do not submit satisfactory certificates are examined in English (punctuation, spelling, grammar, composition, and literature), United States history, ancient history, algebra (through quadratics and including the progressions and binomial theorem), plane geometry (five books of Chauvenet or equivalent), and physics (one year's work). Deficiency in any one of these subjects may be sufficient to cause rejection.

FIFTY YEARS OF SERVICE

By Lieut. Comdr. Roy C. Smith, Jr., U. S. N.

WITH this issue of the Proceedings, the United States Naval Institute celebrates its fiftieth anniversary. It seems, therefore, appropriate at this time briefly to review the history of the Institute.

In the fall of 1873, a number of prominent officers of the Navy met at the Naval Academy to consider the organization of an association for the advancement and dissemination of scientific and professional knowledge throughout the Navy. "That our Navy should have a professional forum, similar to the Journal of the Royal United Service Institution (British) was generally recognized." It seems probable that this idea, from which the Institute has grown, sprang from the brain of Commodore Foxhall A. Parker, and that he must have had the cordial endorsement of the then Superintendent of the Naval Academy, Rear Admiral John L. Worden. He also had the enthusiastic cooperation of such members of the Academic staff as Commander Edward Terry, U. S. N., later Commandant of Midshipmen, Chief Engineer C. H. Baker, U. S. N., Captain McLane Tilton, U. S. M. C., Medical Director Philip Lansdale, Pay Inspector James D. Murray, Lieut. Commanders P. F. Harrington, J. E. Craig, Commander S. Dana Green, Lt. Commanders C. F. Goodrich, P. H. Cooper, and C. J. Train.

The activities of these officers resulted in a meeting on Thursday, October 9, 1873, at which Rear Admiral Worden presided. The objects of the association were stated, the name, United States Naval Institute, was adopted, and the organization launched on its career of service to the Navy and to the Nation. At this meeting Commodore Foxhall A. Parker read a paper on the Battle of Lepanto. This was the first paper read before the Insti-

Editor's Note: This article originally appeared in the Proceedings in October, 1923. Since that time the increase in the Institute's membership has been so great that it is believed many readers will be interested in this historic review.

tute. It was not published in the PROCEEDINGS, however, but appears to have been published elsewhere.

The new Institute at once secured the cordial approval and support of officers in Washington, such as the Admiral of the Navy, David D. Porter, Commodores Daniel Ammen, C. R. P. Rodgers, and Commander J. C. Howell. In the early affairs of the Institute, as was to have been expected, Captain, later Rear Admiral, Stephen B. Luce, was ever to the front. In December, 1873, thirty-six names appeared on the rolls, and of those the following three survive: Rear Admirals P. F. Harrington, C. F. Goodrich, and J. E. Craig. By the end of the first year, the membership had grown to sixty-nine, and of those three additional survive, namely: Rear Admirals F. J. Higginson and W. H. Brownson, and Professor N. M. Terry. These officers may well be regarded by us, their successors in the Institute, as our "Elder Statesmen."

When first organized, the Institute held monthly meetings at which papers were read. The first number of the PROCEEDINGS was issued in 1874 and contained a paper read by Captain S. B. Luce, U. S. N., at the meeting held November 13, 1873, entitled "The Manning of our Merchant Marine." From that date the PROCEEDINGS have continued to be published; at first quarterly, then bi-monthly, and now monthly.

The Constitution at first adopted provided for a Patron, who was the Secretary of the Navy, at that date the Honorable George M. Robeson; a President, the Admiral of the Navy *ex-officio;* a Vice-president; a Council of Regents consisting of the chiefs of the Bureaus of the Navy Department and the Commandants of shore stations; an Executive Committee corresponding to the present Board of Control; a Recorder and Treasurer; a Secretary; and a Committee on Printing and Publication of Papers. Many of these offices have been discontinued, notably those of Patron and the Council of Regents. The Executive Committee and the Committee on Printing and Publication of Papers appear to have consolidated into the present Board of Control; and the other offices consolidated into the office of Secretary and Treasurer, to aid whom a new office, that of Assistant Editor, has recently been established.

For the first year, the office of President was held ex-officio by the Admiral of the Navy, David D. Porter. His *locum tenens* at the Naval Academy, which has ever been the seat of the Institute,

was Rear Admiral John L. Worden, then Superintendent. The next year, in 1874, Admiral Worden succeeded to the office of President, which then ceased to be an ex-officio office. The first Vice-president was Rear Admiral C. R. P. Rodgers. The first Recorder and Treasurer was Chief Engineer Charles H. Baker, U. S. N., and the first Secretary, Professor James Russell Soley, U. S. N. A.

At the outset it was planned that the Institute would have branches at all shore stations, and also on all sea stations, home and foreign. Hence, a President at Washington was the proper thing. During the course of the first fifteen years of the life of the Institute, the branches elsewhere than Annapolis appear to have dissolved, the New York and Washington branches outlasting the others. The work was accordingly concentrated at the Naval Academy, where it had been started, and more attention was given to the publication of papers in the Proceedings than to having them read before a meeting. Meetings, nevertheless, continued to be held regularly until about 1895 or 1896, and at intervals thereafter at which papers were read prior to publication. Since that time, only rarely have papers been read, but of course the annual business meetings have always continued to be held. As a recognition, perhaps, of the vital part the Naval Academy has played in the life and growth of the Naval Institute, the Superintendent of the Naval Academy has almost always served either as its President or Vice-president.

The membership of the Naval Institute, as first recorded, in December, 1873, consisted of thirty-six officers. At present it consists of 143 life members, 4008 regular members, who are or were at the time of joining officers of the Navy, Marine Corps, or Civil Officers attached to the naval service, and 497 associate members, officers of foreign services, the Army, the Coast Guard, the Naval Reserve Force, and civilians interested in naval affairs; and four honorary members, the President, the Secretary and Assistant Secretary of the Navy, and President-Emeritus Charles W. Eliot, of Harvard University. This total membership of 4652 shows the healthy growth of the Institute since its founding with thirty-six members in 1873.

The magazine, the Proceedings, has been published regularly since 1874, and has always held high rank among the professional magazines of the world. It is sent, either by subscription or ex-

change, to nearly all countries, and in particular to all boasting of navies. As a side line to the publication of the PROCEEDINGS, and in conformity with the object of the society, the dissemination of scientific and professional knowledge throughout the Navy, the Institute in 1898 took up the publication of books on naval and allied subjects, the first being *The Log of the Gloucester* and Fullam's *Instructions for Infantry and Artillery,* published in 1899. These books are largely those used as text books at the Naval Academy or as reference or drill books in the Navy at large. The list is now extensive, and embraces well known works on navigation, seamanship, marine engineering, ordnance and gunnery, electricity, radio engineering, and other professional subjects.

In considering any history of the Institute, one may well be struck by the caliber of the officers who founded and who carried on its work. The founders have been mentioned. Prominent among those who have carried on the work thereafter are Rear Admirals Sampson, Jenkins, John Rodgers, C. R. P. Rodgers, Edward Simpson, H. C. Taylor, Richard Wainwright, Caspar F. Goodrich, and others who served as President. Rear Admiral Goodrich has ever had a great interest in and influence over the affairs of the Institute, as have had Admirals Fiske, Sims, Knight, and others. The Prize Essays, established in 1879, have brought out a wealth of valuable material and useful precept, and their authors, among them most frequent, Luce, Mahan, Goodrich, Schroeder, Richard Wainwright, Fiske, Niblack, W. L. Rodgers, Alger and many others, include a galaxy of leadership, and of authority in their profession, such as few other comparable magazines can boast.

Many able officers have served as secretary. Among these may be noted Professors Hendrickson and Charles E. Munroe, Rear Admirals Sampson, Wainwright, H. S. Knapp, Eberle, and Jackson, Captains Beach and Ralph Earle. Longest in point of service was the late Professor P. R. Alger, who filled the post from 1903-12. Here, as everywhere else this astonishing man labored, he left behind him a tradition of unsurpassable service. Nor would any history be complete without mention of Mr. James W. Conroy, clerk and trustee for the Institute for nearly forty years. A new Secretary, Beach, once spoke of him as "the ever faithful Conroy," and of his value to the incoming Secretary.

His death last May has left a deep void which will be a long time filling. In writing such a history as this his help would have been invaluable. He alone knew hundreds of interesting details that, without him, alas, will probably never be brought out.

But leaving the men who have made the Institute, let us consider for a moment the work that they have done, and what yet remains for us, their successors, to accomplish.

In these days, it is the rule always to set a *mission* when starting out to do anything. It would not appear that any definite mission was, in this case, set as such. It was, however, very well understood what the Institute was for, which amounted to the same thing. The lack of a definitely worded mission was probably a good thing, as it has permitted the papers published from time to time to treat of the various pressing subjects as they arose. There was always an object, mission, if you will, but always it has been so broad, that papers on almost any subject, scientific, professional, or historical, if well presented, would find room within the pages of the PROCEEDINGS.

It is of the greatest interest to look back on the files of these PROCEEDINGS. From the very beginning we find plainly evident a forward looking view. Always writers are looking ahead, seeking new methods, new ships, new guns, new ideas for the manning, the supply, the development of the Navy. It is scarcely too much to say that every advance made by us in any branch of naval science has first been threshed out in the pages of the PROCEEDINGS. We can follow the development of the battleship from the post-civil war type of glorified monitor to the present *Colorado*. We can follow the arguments for and against the all big gun battleship, and how strangely they fall on our ears now! We can follow the introduction of oil as fuel, the introduction of turbines, and finally of the electric drive. We can follow improvements in fire control, in spotting, in gun laying, from the first stirrings of dissatisfaction with then existing procedure up to the present director methods of gun laying, with aerial observation of fall of shot. It is scarce too much to say that, with the possible exception of the War College at Newport, no other source has so greatly furthered the material development and professional advancement of the Navy as has the Naval Institute. Nor should we entirely lay stress on material advancement. Articles of historical and scientific note are scattered all through the files. The mental and

professional needs of the personnel have been served fully as well as has the material development of the Navy. Indeed, to anyone interested in the development of our own Navy, or that of foreign navies as well, the PROCEEDINGS may well be regarded as indispensable. One need hardly go outside them for data on this subject. Surely the founders must hold that the Institute has more than justified itself. Surely we may hold that every officer in the Navy should be a member; that every midshipman should join upon graduation. Professor Alger's advice to graduates was, always to take up a specialty; and he advised them further that in no other way could they keep in touch with their profession save by careful study of the progress marked out in the PROCEEDINGS.

The continued value to the service and to the country of the Institute is largely bound up with the question of censorship, or departmental muzzling. This is a most delicate subject to tackle, but one that must be faced squarely and honestly. In the words of Flammarion, "Free and loyal discussion is necessary to conquer the Truth," and Voltaire (was it not?) "I wholly disagree with what you say, and shall defend to the death your right to say it." We also must uphold this principle. Fortunately we are removed from the days when a distinguished officer of the Navy was forbidden to print in the PROCEEDINGS an article, every statement of which was derived from the Secretary's annual reports and other documents aleady published to the world at large; those same days when another distinguished officer was forbidden "even to say that two and two make four."

Relations today with the Department are most cordial and sympathetic but the future is as a curtain through which we cannot see; and in this connection, part of a letter from Admiral Goodrich may well be quoted and preserved as a guide to our successors.

> . . . . we should all clamor for the desirability of an officer's speaking out at will. For myself, both as President of the Institute (and therefore officially) and at other times, I have verbally and in writing, urged various Secretaries of the Navy to remove all restriction on the Institute publications, averring that no officer would abuse the privilege by printing anything confidential in nature. "Encourage all, especially the youngsters, to blow off their steam," I would say. "If any individual be guilty of personal attacks or of improper language and motive, punish him for conduct unbecoming an officer and gentleman, or whatever the offense may be. But eliminate all censorship, and don't shut up the open discussion

of service and naval policy topics." And I added, "Doubtless much of this material will be useful only in letting a chap unburden his mind, but occasionally the Department will get a suggestion of importance which would never reach it through routine channels."

Admiral Goodrich's view is one that we cannot but subscribe to, all of us, and the Institute should ever tactfully and gracefully work to that end. Within recent memory times have arisen, and they may arise again, when we shall have to fight for this principle. Then, like Admiral Sir John Fisher, we can't be silent, and we must not lie.

The Naval Institute of the past has lived up to this principle. It has faced its problems squarely and honestly. That in the future it shall do no less we may confidently assume. And there are problems yet to face. Those confronting the Navy of today are fully as great as, if not greater, than those of the past. Where the past was concerned first with preventing dry rot from attacking the Officer Corps, then with the up-building of the fleet, today we are concerned with the maintenance of the fleet as settled by international agreement, with the utilization and training of this fleet, and with the education and training of its officers and men. These problems are tremendous. In view of the increasing importance of the external relations of the Nation, which the Navy serves, they cannot but be considered fully as vital as were the earlier ones of growth and development. As in the past, so in the future. Toward the solution of these problems the Naval Institute, with all the intelligence it can command, must ever strive.

DISCUSSION

Light Cruisers

(See page 1733, September, 1926, PROCEEDINGS)

CAPTAIN H. C. DINGER, U. S. NAVY.—The question of what should be the characteristics of the new treaty cruisers is a matter of timely interest. Commander Howard has presented the general aspect of the situation in a clear and concise manner and the discussions contained in the September issue have amplified these. These comments have, however, been written somewhat more from the standpoint of what is desirable than that of what is the best compromise to make under the conditions that the designer has to face. There may be some difference between what we desire and what we can get. That design is the most successful which obtains the most all-around value and to do this the full advantage of all possibilities should be taken rather than the mere meeting of certain defined paper conditions.

The design of the best cruiser for the U. S. Navy in its final analysis comes down to the matter of the most effective distribution of displacement. If we have the maximum loaded displacement permissible, it is then a problem of dividing this displacement up and assigning it where it will do the most good.

Speed. Authorities seem to agree on a speed of 33 to 35 knots as the minimum desirable, suppose we say 34 knots. Then another point is endurance at low speed, 12 knots, and at high speed, 30 knots. If we wish to have 3,000 miles at 30 knots this will call for an oil capacity of about 1,800 tons for the 10,000-ton cruiser. This capacity at 12 knots can give from 8,000 to 20,000 miles cruising radius depending upon the machinery that is provided. With comparatively little added machinery weight the cruising radius at low speeds can be doubled by using Diesel electric cruising equipment but this may mean a sacrifice of some ten per cent of cruising range at higher power. We can not have something for nothing; I am personally in favor of securing the increased cruising range at low powers, because this quality will enable the vessel to operate for long periods without refueling and will make it possible to have the cruiser supply fuel to smaller vessels in an emergency, and in general will add to the sea-keeping qualities which are essential for a cruiser. If we decide upon a tentative fuel capacity and have a limit of total weight for fuel and machinery assigned, the problem for the machinery design becomes

one of obtaining the most economical and effective distribution between machinery weights and fuel and between better reliability at the expense of cruising radius. This, then, becomes a search for securing the lightest and most economical machinery while at the same time meeting reasonable demands for reliability. If we adopt three screws, or if possible two,* instead of four and if we use large boiler units we can save weight without any real decrease in reliability. This weight can be applied to devices for obtaining better economy such as stage heating, superheat, special cruising arrangements, more effective lagging, air heating, etc. Any added economy of fuel automatically increases the cruising radius at low powers, but the added weight, due to economy devices, may reach a point where the radius at high powers is decreased. There must therefore be a general balancing of all these variables; but anything that goes to save fuel is a weight saver, and a displacement saver.

The use of considerable higher steam pressure has been urged as a means to securing fuel economy and the saving of weight and space. This it will do but only to a relatively small extent. If the pressure were raised from 300 pounds to 500 pounds, the gain in fuel economy might be as much as four per cent. The cost would be increased and there is also the possibility of introducing various other difficulties.

Armament. There is usually a serious danger of over-gunning vessels at the expense of ammunition supply and proper service. Too many guns can not be well served. Assuming that an eight-inch gun is to be used, certainly eight of these in twin mounts is as heavy a main battery as can be justified or properly served. A secondary battery of some six or eight anti-aircraft guns, as large as practical would supplement this. If there is any armament weight left over let us put it into extra ammunition. Torpedo tubes appear to be out of place on these vessels. Their installation on cruisers is a sad history of misplaced effort going back thirty years or more.

Protection. In view of the high speed, large radius desired and the heavy armament there is not much weight left to apply to protection. How much is justified, if any? Assuming that the main battery itself is to be protected by light armored turrets, what else is justified? A heavy armored protective deck and a complete belt of side armor is hardly possible, but the strength deck might be made a little heavier and also the side plating at the water line in the wake of the large compartments and about the steering gear. This added metal might keep out projectiles from destroyers and small vessels and would give a certain protection

* Propeller conditions may be such that owing to limited draft the proper surface can not be secured on two screws for a very high powered cruiser. For a thirty-knot cruiser two screws might be used.

for which the extra 400 or 500 tons of weight required might be a justification.

If, however, we attempt to apply armor to any considerable extent we will require weight that can not be assigned without serious sacrifices in other characteristics. There is much to be said for the school of thought that would put no armor at all on light cruisers. Many such vessels exist.

The *Richmond* class of cruisers are quite effective vessels and the assignment of displacement as between fuel, machinery, armament, protection is quite satisfactory. The design is somewhat unbalanced by reason of numerous major changes during construction.

The final armament is quite different from that of the original design and can be improved upon. Likewise the living arrangements for the crew are inadequate due to large additions to the complement after the vessels were partially completed. The machinery can be improved upon by using three instead of four propellers and by applying later developments that will tend to lightness and improvement in steam consumption and simplicity.

Displacement is not elastic, it can not be stretched and every bit of it must be paid for. If any of it is wasted or ineffectually used the design suffers.

Economy in funds, application. The trend in the design of our cruisers now seems to be to go the limit of the displacement without regard to money. This can well be carried too far since we are not restricted as to number of cruisers but are and always will be restricted as to money. Therefore we should also have in mind the securing of the greatest possible value for the money expended.

An extra knot or two means much more money. Some specially light designs may be very costly. If this is carried to an extreme we may have a certain superior cruiser costing double what some more ordinary cruiser would cost. Will the superior cruiser be worth, in naval value, the equal to two vessels of the less effective design?

This should be considered. For many purposes the cheaper vessel may fill the bill. Extra expense should only be incurred when and where it produces an adequate return. Costly things that do not really pay for themselves should be discarded. If the money value as well as the military value of all the matters that have been incorporated into a design were critically analyzed it would disclose numerous unjustified matters which might well be eliminated. Another matter to be considered is the question of money for alterations on old vessels versus new construction. For the condition now confronting this country alterations on old vessels should be brought to the minimum while new construction of the most desirable types should be brought to the maximum

that available money permits. Revamping some old vessels is not worth near as much as building a less number of well designed and up-to-date ones. A navy can not be up-to-date unless a reasonable amount of new construction is kept in hand. When new construction ceases, progress in material improvement is arrested.

Simplicity. Simplicity is an ideal that should be secured as far as possible and the tendency to put in too many things, too many alternate services, too many stand-by arrangements detract from this and eat up displacement. We should try and leave out as much as can be, instead of putting in everything that appears possible. The ideal of the "one horse shay" is what should be aimed at. One design can not be made to be a little of everything and be efficient, only one thing can occupy the same space at the same time and no two things can use the same displacement. Decide upon the main purposes and characteristics of the vessel, then develop these to their utmost and with as little interferences as possible. If we put in too many things, one is bound to detract from the effectiveness and efficiency of the other.

Best displacement. The trend is now to secure the limit of displacement allowed by the treaty. Such a displacement is not necessarily the one that should be adopted. If, for a certain sum of money a larger number of smaller vessels could be built whose total naval effectiveness would exceed a smaller number of treaty cruisers, then such smaller vessels should be built.

Numbers are desirable as well as superior effectiveness of individual vessels. The purpose for which the vessels will be used also may effect the decision as to displacement. If they are to be used chiefly as raiders, screening vessel and for destroyer support, they may perhaps be smaller. As we already have ten of the *Richmond* class and 10,000-ton cruisers are to be found in the building programs of numerous foreign countries, the decision for the present to build 10,000-ton vessels appears to be a logical one. But this need not hold indefinitely.

Training Naval Officers

(See page 1746, September, 1926, Proceedings)

Brockholst Livingston.—Lieutenant Commander Tawresey in his article brings to the front again the important subject of the continual education of naval officers that their knowledge may be kept abreast of the advance in the complicated art of naval science.

The education of the naval officer is similar to the education of enlisted men only inasmuch as all education can be compared. The problems and complexity of the former are so huge that we hesitate to mention the one with the other; the training of the enlisted personnel is so elementary, that of an officer so advanced. Should not an officer to properly supervise, embody all the knowledge of

the enlisted man as well as that higher education of command? But does the human capacity allow this? We should stray from our purpose if we delved further into the limitations of man and consequently we shall leave that to those whose education better fits them to handle the subject.

Some words used by the author of the article bear repeating in full. He writes: "Naval officers have the idiosyncrasies of any similar group of average persons. . . . . Still others will and do study constantly in spite of all odds. Even the last mentioned suffer from the lack of systematic, uniform method of professional training. They study such documents as they can procure, according to the best system they can procure and devise . . . . they have not an authentic and official guide to their studies, nor have they any authentic, official expression of the service experience and opinion in the subject they are learning. . . . .

"Untrammeled, individual research doubtless stimulates independent thinking and so has certain advantages. It is apt, however, to place undue emphasis on relatively unimportant features . . . . and is an expensive process in point of time." These few sentences are applicable to more than the education of naval officers. They also apply to the Navy's publicity and the training of the naval reserve. We need systematic, uniform and officially sanctioned education and publicity.

There is much to be said in reference to "a periodic journal for officers" which should "contain the latest authentic professional information and should be as useful and beneficial to naval officers as are reputable medical journals, for example, to wide-awake doctors." To publish an official journal, might we say, in competition with the PROCEEDINGS, would be a great mistake. The members of the Naval Institute have been asked for suggestions for improving the means undertaken for carrying out the aim of the Institute which is: "The advancement of professional, literary and scientific knowledge in the Navy." The one which the present writer would offer with all sincerity would be to improve still further the "professional notes" which are now "the most valuable part of the publication." This is preferable to an absolutely official publication. Let the Navy Departmental detail an officer for duty with the Institute in the "professional notes" section. Let him "sift the wheat from the chaff," strike "a balance . . . . . between various professional matters," and, in consultation with higher officers, give "the authentic official version of all controversial or confused subjects. . . . ." Commander Wallace, while secretary-treasurer, voiced his belief in the need for a specially detailed officer for duty with the Institute. "I feel," he wrote in his annual report for 1924, "that the Naval Institute PROCEEDINGS, in furnishing a medium for bringing before the service not

only the matured opinions of the officers best qualified to speak on the various subjects, but also a compendium of useful professional notes and other information, and still further, in giving to the Navy the opportunity to discuss questions vital to its welfare, does a real service. . . . . The duty [of secretary-treasurer] may well be regarded as semi-official in character and official importance. I believe that the time will come, and indeed has already arrived, when the importance to the Navy of the Naval Institute is such as fully to warrant the detail of a suitable officer to that duty, not as a side issue, but just as any other detail in the Navy is made."

The present writer hesitates to criticize the Institute's policy towards articles of historic rather than scientific interest but it has been noticed that there recently has been an increasing number of the former. Would it not be wiser to devote the space taken up by these to an enlarged "professional notes" section? Would we not be doing more towards carrying out the real purpose of the Institute?

Through the medium of this semi-official publication we could reach, in associate membership, a larger civilian group. We should be carrying the Navy, in its professional aspect, to the people.

To greatly increase the correspondence courses for regular officers, would, in my mind, be partly a waste of time and energy. An officer, upon graduation, is supposed to embody the rudimentary principles required. Postgraduate courses fit him for special duties. The War College courses, in their various branches, fit him for command. These, augmented by the notes on the advance in naval subjects, appear to be sufficient. We are not *training* an officer. We are *keeping him abreast* of his art.

Commanding officers, even without the pressure of the regulations, should supervise the study of the officers under their command. Conscientious commanders do so supervise. The practice can be extended in the form of periodic meetings during which various matters can be discussed. The commander's advice should also always be available to younger officers.

As to a reward for the completion of courses, we all know that one does not enter the naval service for monetary gain. Recognition in other ways would appear to be sufficient recompense for most officers. The note in the Navy *Register* would not only be a sign of reward but also useful to others.

The Spoils of War

(See page 2020, October, 1926, PROCEEDINGS)

The New York *Times* (Editorial), October 6, 1926.—A posthumous article on aviation by Commander John Rodgers appears in the October number of the United States Naval Institute PROCEED-

INGS. It is entitled "The Spoils of War." "On returning to the United States in September of last year, after floating on the Pacific more or less peacefully for a period of nine days, I found the country," said the writer, "in a state of turmoil. I had the impression of being thrown into the midst of a great 'battle royal,' where everybody was fighting everybody else, each for himself." The cause of strife was the future of aviation, and the principles were the Army, the Navy, civilian aviators, manufacturers and the newspapers. At the time the President's Aircraft Investigation Board was in session. With its report everybody was disappointed, "but as times goes on," said Commander Rodgers, "no matter what class of contestants he belongs to, one cannot help realizing more and more the constructive and real value of the report." Commander Rodgers, who soon took up his new duties as assistant to Admiral Moffett, Chief of the Naval Bureau of Aeronautics, could speak only for sea service:

> The interest of the Navy as a whole has been advanced in direct ratio to the advancement of aviation. There has been brought about a better understanding, and what appeared to be conflicting interests are merged into one interest, the development of the Navy. For these results the Morrow Board is primarily responsible, and the country, as well as the navy, owes to it and to the naval committees of Congress a debt of gratitude for the work performed and the sagacity displayed in the handling of a most difficult situation.

He pointed out that before the meeting of the Morrow Board the Naval Bureau of Aeronautics prepared, and the general board of the Navy approved, a five years' construction program. But it was the admirable report of the Morrow Board, after holding many hearings and viewing all sides of the aviation problem, that impressed Congress with the value of the proposals of the Bureau of Aeronautics. It gave them its sanction, "but so far," wrote Commander Rodgers, "no additional money has been authorized to carry out the five-year building program." It calls for an expenditure of $85,000,000. Ultimately the Navy would have 1,000 modern planes, 667 in operation and 333 in reserve. The faith of Congress is, however, pledged. It may be assumed that, unless the United States agrees with other naval powers to limit armaments, the money will be forthcoming.

Taking stock of "the spoils of battle," Commander Rodgers commended the appointment of additional assistant secretaries of War, Navy, and Commerce to coordinate the activities of the three departments. The established organization is not disturbed, he said. Of the selection of Dr. E. P. Warner of the Massachusetts Institute of Technology for the Navy Department, he was sure that "no taxpayer need have cause to worry that this valuable young man will not earn every cent of the munificient salary of $7,500 which the Government pays him." There is pathos in the

regret that, although flight pay was allowed, there had been no insurance legislation. The writer was soon to lose his life in the performance of his duty.

There had been no legislation to carry out the Morrow Board's recommendation of additional plans for the training of reserves. The matter is one of supreme importance. There should always be an expansible peace nucleus of planes, but without a trained reserve of fliers war additions to the air fleet wonld be of little avail. Fortunately, Commander Rodgers said, the Navy Department held out $902,000 of its total appropriation to maintain training schools. The plan is to have twelve reserve squadrons.

Naval aviators are now detailed in the offices of the Chief of Naval Operations, the Bureau of Navigation, and the Bureau of Engineering. This was real progress, the Commander thought; in time the Chief of the Bureau of Aeronautics would be relieved "from the virtual responsibility in matters in which he has neither legal responsibility nor authority." Nothing in the reforms accomplished pleased Rodgers more than the legislation (although normally it should be a matter of administration) requiring that the command of aircraft carriers or flying schools be given to those officers who, while otherwise qualified, are also naval aviators. In conclusion Commander Rodgers enjoined "the Navy seamen, subseamen, air-seamen and landsmen" to keep up the good work, because, as the Morrow Board has said, "no solution proposed at this time can be lasting."

International Law Still Lives

(See Page 1367, July, 1926, Proceedings)

The New York *Times* (Editorial), 22 August, 1926.—Some too quick despairers have been led by events in Europe this year to abandon hope of the reign of law between nations. Undeniably, there have been disappointments. The Locarno treaties still await ratification. In the disarmament conferences at Geneva there have been long delays and many sharp differences of opinion. The outcome cannot be predicted. But alongside these backward eddies there has been observable a strong central current running in the direction of the settlement of international controversies by agencies and organs of law and justice.

In any survey of the whole field and of the main trend of international public opinion, notice should not fail to be taken of the successive meetings of jurists and statesmen in the hope and aim of strengthening and clarifying international law. One such conference was scheduled for Vienna for the first week in August. It is the first time since the war that the International Law Association has met in one of the former enemy countries. Lord Phillimore made it the occasion of a review of the work of the

association which has been going on for twenty years, and for a statement of some of the subjects and problems that are yet to be taken up. They have more to do with private international law than public, though questions of the rights and duties of neutrals, and of the jurisdiction of the Permanent Court of International Justice, will again come under discussion.

Still more significant, in our opinion, is a paper by Lieutenant Commander Lucius C. Dunn of the United States Navy, reprinted from the United States Naval Institute PROCEEDINGS. He calls it "The Threshold of a New Era in International Law," and in it sums up the work that has been done and is being done in devising plans by which "wars may be averted." Coming from a naval officer and intended primarily for naval officers, this is a sign of the times at once striking and encouraging. Lieutenant Commander Dunn concludes his review of the case as follows:

"It is thus manifest that the whole subject of international law is now engaging the serious attention of the entire world and is causing civilized peoples in every land to devote thought to it as never before in the world's history, which in turn will bring about a universal state of mind favorable to its further development. In truth, therefore, it may be said that we are on the threshold of a new era in international law and the next decade will bring forth marked progress in the realm of world legislation and in the interests of international harmony."

In all these matters we need to take long and large views instead of short and narrow ones. If we do, we can scarcely be left in doubt that international law, with a growing desire among civilized nations to perfect it and live up to it, is still very much alive in the post-war world.

THE NEW 8,000-TON DISPLACEMENT FRENCH CRUISER "DUGUAY-TROUIN" STEAMING AT HIGH SPEED DURING HER TRIALS. (See page 254)

THE NEW 8,000-TON DISPLACEMENT FRENCH CRUISER "DUGUAY-TROUIN" STEAMING AT HIGH SPEED DURING HER TRIALS. (See page 2554)

PROFESSIONAL NOTES

3 OCTOBER TO 3 NOVEMBER

COMPILED BY
LIEUTENANT COMMANDER W. G. GREENMAN, U. S. NAVY

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UNITED STATES

The Merchant Marine Naval Reserve and Its Value to the Entire Nation

Rear Admiral W. R. Shoemaker, Marine Journal, 30 Oct.—One of the most valuable assets in naval preparedness is the Merchant Marine Naval Reserve. The Naval Reserve Act, which became effective July 1, 1925, provided for this important part of our naval organization and regulations for its formation were approved by the Secretary of the Navy. For various reasons, the principal one being the inertia to be overcome in inaugurating any new government activity in these days of restricted budgets, no progress has been made in the actual accomplishment of this project, other than the making of certain plans to develop this great potential asset, as soon as the necessary funds are made available. Its obvious interest to the shipping companies and the personnel of the merchant marine warrants a brief exposition of what the merchant marine naval reserve may be expected to accomplish for the Navy in war and for the merchant marine itself during peace time.

This form of the naval reserve as regards officer personnel has many advantages over other classes. In the first place, its personnel, even before commissioned in the reserve, has had a great amount of sea training which in general compares favorably with that of regular officers. This, therefore, greatly simplifies their reserve training, which may be limited to distinctly naval subjects in which the merchant marine officer does not obtain experience under peace conditions, and the lack of which required many anxious months to overcome when this class of officers were requisitioned for naval service during the World War.

Secondly, the merchant marine officer continues serving at sea almost constantly and this keeps him trained to the minute in the operation of his ship under peace conditions and facilitates his training in distinctly naval subjects.

A principle which has been followed in all classes of the reserve is that we must train organizations, not individuals. It is a simple matter in peace time to list a number of officers and men, but to give both peacetime training and to provide wartime efficiency it is necessary that individuals be grouped into organizations and the closer and firmer these organizations are cemented during peace time the more effective they will be under the strain of war. In the merchant marine, by taking the ship as a unit, and commissioning the master and other officers in the reserve we have a living opus, which would be a great potential operating organization already formed for war value. If the ship should be chartered by the Navy, and operated with a merchant crew the officers would not be called to active service, but due to their

naval reserve experience, would be able to operate with the fleet more effectively than if its officers had had merchant service experience only. If the vessel on which they were serving should be commissioned and manned by the Navy, they would remain on board and constitute the nucleus of its officer personnel.

The fact that the merchant marine officers would continue on their own vessel and in most cases perform the same duties would be of immense advantage at mobilization and, in fact, would be indispensable for its proper operation, particularly as its services would be required on very short notice.

The foregoing concerns the officer personnel only. The enlisted personnel is in many cases of such a shifting character that its inclusion in the reserve during peace time is of doubtful value, except possibly a few men in key positions.

The Navy's plan for the execution of the merchant marine naval reserve is as follows:

First—The department determines and designates the ocean-going merchant vessels which would be required for service with the fleet with naval crews immediately after mobilization.

Second—After consultation with their owners the department designates from the above list the vessels by name upon which "Reserve Groups" would be organized, the numbers of such being dependent upon the funds available. In this selection the vessels would be distributed insofar as practicable among as many shipping companies operating large ocean-going vessels as possible, but special consideration would have to be given to certain vessels which have the highest priority in the mobilization plans. The reserve group would normally consist of all the officers serving on board the vessel selected.

Third—The commandant of the naval district, in which the home port of the vessel lies, organizes the group and obtains commission for the officers in accordance with the naval reserve regulations.

Fourth—The senior officer of the group, under the direction of the commandant, supervises the training of the group, while the training methods have not been worked out in detail, it is proposed to utilize study courses covering distinctly naval subjects, such as Navy Regulations and methods of administration, communications, principles of gunnery and fire control, handling of vessels in convoys and steaming singly in submarine infested waters, and naval engineering. Reserve officers would be required to devote a certain number of hours a month to these study courses and take a brief examination quarterly to qualify for their pay. Subsistence will be furnished officers who volunteer for a cruise without pay on a naval vessel up to fifteen days in duration. Commanding officers of naval vessels have authority to cruise such officers provided they have quarters available.

It is hoped that an appropriation will be secured to pay a limited number of merchant marine naval reserve officers for the fiscal year beginning July 1, 1927.

In addition to being of wartime value to the Navy, it appears that the merchant marine naval reserve would be of equal or even greater value to the merchant marine itself during peace time.

The study courses could not but improve the officer for the performance of his present duties. This applies particularly to the engineer officers, who might effect considerable savings in fuel and other materials by the use of naval engineering methods, developed by many years of intense competition between vessels.

The system of assigning groups designated by name and of paying officers only so long as they continue to serve on these vessels is certain to improve the stability of their officer personnel. The assignment of officers to these vessels will serve as a reward in that it will give them an opportunity to increase their pay by taking the prescribed study courses.

These vessels will also have the right to fly the naval reserve flag, provided the master and fifty per cent of their officers are members of the reserve and this in time may bring a prestige and reputation for efficiency which will be of very real value.

GREAT BRITAIN

The Guns of the Fleet

Engineering, 22 Oct.—The new battleships *Nelson* and *Rodney,* now nearing completion, are in many respects the most interesting vessels of war which have been built in this country for the past twenty years. In appearance, armament and, probably, in structural detail as well, they differ radically from all preceding battleships. It is understood that they are, in effect, reduced copies of the 48,000-ton battle-cruisers of the super-*Hood* class which were ordered in 1921, but subsequently cancelled under the Washington Treaty. As the *Nelsons* are 13,000 tons smaller, it is evident that they must be considerably inferior to the prototype in one way or another, but the sacrifice appears to have been made chiefly at the expense of speed. If so, the decision is to be commended, for the complete suspension of battle cruiser construction brought about by the treaty, added to the fact that of the eight vessels of this type now in existence four belong to the British Navy, has necessarily diminished the importance of high speeds so far as capital ships are concerned. A reduction in engine power was therefore preferable to any sacrifice of armament or protection, and we shall not be surprised to learn that this principle has governed the design of the *Nelsons.* It is now common knowledge that the main armament of each ship consists

of nine 16-inch guns, a caliber new to the British service. Particulars of the new gun are lacking, but its ballistic properties are presumably not very dissimilar to those of the 16-inch pieces listed in the ordnance tables of Vickers, Elswick, and Beardmore. Taking the Elswick gun as typical, it is found to have a length of 45 calibers, a weight of 108 tons, and a projectile of 2130 pounds. The initial velocity is 2,630 foot-seconds, and the muzzle energy 102,160 foot-tons. According to the Tressider formula, the gun will penetrate 58 inches of wrought iron at the muzzle, or 4.3 inch more than the 15 inch weapon of 45 calibers. The rate of fire is returned as two rounds per minute. These figures refer to the wire-wound model, but both Elswick and Vickers list an "all-steel" 16-inch gun, the Elswick piece weighing only 83 tons, though the initial velocity is 2,700 foot-seconds, with a 2,130 pound projectile. The relative merits of wire and all-steel guns have, no doubt, been fully canvassed by the Admiralty ordnance officers. The wire gun has hitherto held the field in this country owing to its superior margin of safety as compared with the solid gun, this advantage being considered to compensate for the greater weight involved. On the other hand, there is no record of any failure in recent years of the all-steel guns with which American, French, and German warships are exclusively armed. In the case of a vessel carrying nine 16-inch guns, the substitution of all-steel guns for the wire variety would represent a saving in weight of 225 tons.

To a certain extent the caliber of the guns in the *Nelsons* class was determined in advance by the Naval Treaty, which fixes the limit at 16 inches. As weapons of this bore were already mounted in foreign battleships, it would have been bad policy to accept anything less powerful for our new vessels. But apart from this consideration, there were sound reasons for choosing the heaviest gun permissible. All the experience gained during the war points to the superior effectiveness of large-caliber guns under modern tactical conditions. Only six of our ships present in the Jutland action had a 15-inch armament, and only four of them were closely engaged, yet it is made clear by the data now available that a large proportion of the most damaging hits sustained by the German ships was inflicted by 15-inch projectiles. At a range of 18,000 to 19,000 yards the fire of the Fifth Battle Squadron—*Barham, Valiant, Warspite, and Malaya*—was so effective that it compelled the van of the German battle fleet to turn away. Even this great distance the 15-inch shells had a remaining velocity of about 1400 foot-seconds, and were thus able to penetrate 8½-inch. K. C. armor. Destructive hits were made on the *Grosser Kurfürst* and other German battleships, and shortly afterwards the *Derfflinger* had two of her turrets destroyed by shells of the same caliber. It is true that the German guns of much lighter caliber—12-inch

and 11-inch—showed themselves capable of delivering a most punishing fire, but this circumstance was due in part to the remarkable efficiency of the German A.P. shell, and in part to the relatively close range at which atmospheric conditions compelled the British Fleet to engage. Our battle cruisers, in particular, had been expressly designed for long-range fighting, and were therefore endowed with great speed and heavy guns, but moderate protection. Their thin armor, which would have been adequate at the great range at which they were expected to fight, became a serious source of weakness at anything below 16,000 yards, and as ill fortune would have it, the heaviest exchange of fire took place at ranges considerably less than this. All German versions of the battle are in agreement as to the material and moral advantage that the grand fleet enjoyed by virtue of its ponderous guns. Nor should it be overlooked that the Germans themselves had decided, two years before the war, to adopt 15-inch guns for their battleships of the *Bayern* class. A novel feature of the *Nelsons* is the mounting of their 16-inch guns in triple turrets. They are the first British ships to be equipped with such turrets, though every other major navy save the Japanese had introduced that system before the war, and as long ago as 1909 a British firm—Armstrong, Whitworth & Co.—designed and manufactured 12-inch triple turrets for the Italian battleship *Dante Alighieri*. The delay in adopting three-gun mountings for British ships was due, not to official conservatism, but to cogent reasons of a very practical nature. In the first place, our standard system of armament before the war provided for two turrets forward and two aft, in order to bring at least four guns to bear on any point of the horizon. As our ships were, as a rule, armed with guns of heavier caliber than those in foreign vessels of the same period, it was not thought necessary to mount more than eight per ship. It will be seen, therefore, that the triple turret offered no particular advantage to our navy in pre-war days. But war experience has induced a revision of the tactical principles that influence battleship design. Special importance is now attached, first, to the maximum weight and volume of fire, and, secondly, to the strongest possible protection of gun positions. To meet these two *desiderata* it has been found expedient to mount nine heavy guns instead of eight, and to house them in triple turrets for economy of weight; further, to group all three turrets in the forward part of the ship, this concentration enabling strong armor to be worked into the gun houses, barbettes, and trunks. By this method a higher degree of protection has been given to the nine guns than would have been feasible in the case of eight guns twin-mounted in the conventional fore and aft positions. While objection may possibly be raised to the loss of stern fire which this arrangement entails, we are inclined to think that the de-

signers of the *Nelson* and her sister have found the best solution of a difficult problem. A theoretical draw-back to the triple turret is its lower rate of fire per gun as compared with that of a twin mounting, but it will be within the recollection of our readers that exhaustive tests with an experimental three-gun turret were carried out by the Admiralty five years ago. Had these proved unsatisfactory in respect of firing speed or any other essential quality, it is unlikely that the turret would have been approved for the new ships.

The normal development of naval artillery has been arrested by the restrictions imposed on capital ship construction by the Washington Treaty. But for the treaty, it is morally certain that the trend of progress would have been towards larger calibers. Guns of 18-inch bore were produced in this country during the war, and one was actually mounted in the battle cruiser *Furious*, though it was soon found to be too powerful for her scantling. Lord Fisher told us in his memoirs that had he remained at the Admiralty "a 20-inch gun would have been in the *Incomparable*—a ship he had designed as the "last word" in battle cruisers. It was just as well for the tax-paying community, perhaps, that this "battle of the calibers" was abruptly terminated by international agreement. In 1921 we were already in sight of the 55,000-ton ship, armed with 18-inch guns, and costing £10,000,000. Competitive building on this basis would have been ruinous to a war-impoverished nation, and capital ship supremacy—which does not necessarily imply all-round naval supremacy—would soon have passed to the competitor with the longest purse. Barring unforeseen contingencies, the treaty will remain operative till 1936, so that no increase in the caliber of naval guns is to be anticipated for the next ten years.

Navy Promotions and Prospects

Army and Navy and Air Force Gazette, 23 Oct.—A good deal of discussion is likely to be aroused in the fleet by the order of Saturday last extending the promotion zones in the executive branch. The zone of commanders for advancement to captain has been widened from officers with from five to seven and one-half years' seniority, to those with from four to eight years; and that of lieutenant commanders for advancement to commander is extended from two and one-half to six years, to from two to six years. The former zone is thus extended both at the top and the bottom, and the latter zone by six months at the bottom end. About sixty-four more commanders will be competing for places on the captains' list by these changes, and about fifty-nine more lieutenant commanders will be in competition for the rank of commander, the totals in the respective zones being increased to about 192 and to 447 respectively. As the number of promotions made

in recent half-years has been only ten to captain and twenty to commander, it will be seen that only one out of every nineteen commanders in the zone stands a chance of going up, and only one in every twenty-two lieutenant commanders. It is indeed a case of many called, but few chosen. Nor can the pressure be relaxed very much, it would seem, until the heavy promotion lists during the war are worked off, or unless the authorities take special steps to make another clearance higher up the lists.

It is naturally being wondered whether the new order is the outcome of a recommendation of the Chelmsford Committee which is sitting to investigate the condition of the lists of executive officers, since the tendency since the war has been to contract rather than to expand the lists. The chief effect of the new zone for commanders will apparently be to include again the large group of those promoted to commander in December, 1918, who were thought to have been in the zone for the last time in June, 1926. There were no less than sixty promotions to commander on December 31, 1918. Over a score were "axed" in 1922, and there remained thirty-one in the zone in June last, when seven of the ten vacancies for captain were distributed among them. It has evidently been thought advisable to give the remaining twenty-four another run, and none could say they have not earned this further chance. Eight of them wear the D.S.O. for war service. As for the lieutenant commanders, the alteration of the lower limit of their zone from two and one-half to two years restores it to what it was just after the war. It went up to three years in 1921, apparently to give the more opportunity for the war-promoted men. Of course, it does not necessarily follow that a change in the bottom limit of the zone will make such a difference as one at the top, if it makes any at all. In June last the lower limit was altered from three to two and one-half years, but no two and one-half year officer benefited, the junior having completed four and three-fourth years, and all but two over five years.

It is this tendency to take most of the new captains and commanders from positions high up the zones which, coupled with the raising of the zones themselves, makes the prospect of maintaining a young flag list rather dismal. An officer promoted to lieutenant at twenty-two automatically becomes a lieutenant commander at thirty, but if he has to go to the top of the zone before getting the next step he does not become a commander until thirty-six, and if again he has to go eight years in this grade he is forty-four by the time he gets on to the captains' list, which barely leaves him eleven years (the present average) in which to serve until promoted to rear admiral, before the age limit clears him off at fifty-five. Before the war, officers were being promoted with little more than half these periods as lieutenant commander and commander. Lord Jellicoe was a commander at thirty-one and a captain at thirty-

seven; Admiral Madden a commander at thirty-three and a captain at thirty-eight; Admirals Sturdee and Oliver were longer in getting on to the commanders' list which they did not reach until the age of thirty-four, but they were both captains at forty. Most, if not all, of the great war leaders had become captains well before attaining forty, but of the 1926 promotions even the *average* was above this age. Yet the Admiralty now deems it necessary or expedient to increase the maximum time in the zone. It can only be hoped that the change now made is temporary. The fluctuations each year must also be unsettling to the majority of officers, who are less able to judge their own prospects and to make plans accordingly.

Scapa Flow Salvage Operations, 1 October

The very successful salvage operations which have been carried out by Cox & Danks, Ltd., of 168, Regent Street, London, in connection with the raising of the scuttled German fleet at Scapa Flow, have already been referred to and illustrated in *The Engineer* in our issues of January 2 and September 4, 1925. In a period which extended from July of that year until early last May, twenty-five small and large destroyers were raised and dealt with. Many of these boats were sold to shipbreaking firms, while others were dismantled and broken up by the salvagers' own shipbreaking department at Lyness Pier, Orkney Islands. At the present time only a few bare hulls of these ships are to be seen in the adjoining Mill Bay, and these, we understand, will be broken up during the coming winter season.

With the completion of the first part of its salvage program early in 1926, the firm turned its attention to the more difficult problems involved in the refloating of the larger ships. It will be recalled that about November, 1923, Cox & Danks, Ltd., purchased from the Admiralty the wrecks of the *Hindenberg, Moltke, Seydlitz* and other ships, along with the destroyers already raised. Early in May, a thorough survey of the battle cruiser *Hindenberg* was made by the firm's diving staff, and a scheme was worked out for lifting her. A few weeks ago, by the courtesy of Mr. E. F. Cox, we were invited to visit Scapa Flow and to inspect the salvage arrangements for raising that vessel. Before describing them and outlining the work of the present season, some detailed particulars of the sunken battle cruiser may perhaps be given, as the work on her has occupied most of the summer and has only been deferred on account of the failure of two water-tube boilers—thus cutting off a large portion of the pumping power—and the uncertain weather of the autumn season at the Orkney Islands. Work upon the ship will be resumed, we understand, in the early spring.

The Battle Cruiser "Hindenberg"

The ship, as scuttled, lies off the Island of Cava to the west of Scapa Flow, in a position approximately north and south, in about eleven and a half fathoms of water. She was, we understand, towed to this position, while in a sinking condition, with the object of preventing her, if possible, from becoming completely submerged. In the position in which she sank the boat deck is just awash at low spring tides, while at ordinary times the jackstaff is just about covered, and there is nearly twenty-eight feet of water over the after quarter deck. These levels are to be largely accounted for by the natural sheer of the ship.

The Salvage Plans

Various plans for refloating the ship were investigated. They included a project for raising the wreck by means of air-filled pontoons, and also a scheme submitted by a firm of German salvage engineers for freezing up the deck apertures and then expelling the imprisoned water by compressed air. Both these plans were, after consideration, rejected in favor of the firm's own scheme for sealing up all the deck and ship side openings, outboard valves, etc., and reclaiming the ship intact by means of direct pumping.

The carrying out of such an extensive salvage operation naturally involved the provision of suitable floating bases, with power, lighting, compressed air, oxygen and acetylene gas, and other necessary services. Fortunately, these were in part already to hand. It will be remembered that in order to raise the torpedo destroyers, Messrs. Cox & Danks made use of a part of the large submarine repair dock which was delivered up by Germany under the Peace Treaty. The center section of that dock was removed, and it was transformed into two floating pontoons fitted with hand operated winch gear. The side walls of the dock were, however, retained, and the pontoons so provided, afforded excellent office, store, and power plant accommodation. Two further pontoons were added later. Like the first two, they were also sections of a large floating dock. These larger pontoons are each equipped with boilers and steam and oil engine driven power plant, and a large space is also available on them for joiners', shipwrights', engineers', and blacksmiths' workshops. These four pontoons were moored alongside the wreck. Access to the above-water decks of the *Hindenberg* was during the operations given by two suspension bridges with adjustable cables, which were formed of planks laid upon the wire ropes. In order to shield the wreck from northerly winds, two destroyer hulls were moored to the north of the wreck, and formed a breakwater, giving a protected area for the diving operations. In the mooring of the pontoons referred to, good use was made of the ships'

anchors. They include two 9-ton and five 7½-ton anchors, as well as several 4 and 3½-ton anchors. They were disposed in a suitable manner around the area of operations, and use was also made of the 19,000-ton sunken hull of the *Von der Tann*, which afforded an excellent holdfast for one of the pontoons.

The main work of getting the first pontoon into position was begun early in March of the present year, and by the middle of that month it was possible to begin the patching of all the deck and side openings. This operation was started at the forward end of the ship and continued in the direction of amidships. By about the middle of that month, some fourteen divers were constantly employed on this work. The patches varied in size from small plugs of only a few inches in diameter up to the largest patch which had an area of 760 square feet, and they numbered over 700. It was necessary to cover a deck aperture of about 38 feet by 20 feet, which was left when the damaged after-funnel of the ship was removed. This funnel, which was half-cased, was so badly holed by corrosion that its complete removal by oxy-acetylene burning was necessary before a watertight joint could be made.

In the early stages of the work operations were somewhat delayed by uncertainty as to the exact subdivision of the ship. It was therefore decided to search likely places in the ship for information on this matter and the disposition of the various flooding valves. After three days of search by divers, an almost complete set of ship's plans, including piping and flooding plans, was discovered in the lower control rooms. It is worthy of mention that a number of these plans, including those of the flooding arrangements—we have had the privilege of personally inspecting and handling them—were engraved upon non-ferrous sheet metal in a manner which rendered them practically indestructible. As was to be expected, some of the instructions were rendered illegible by incrustations formed during nearly seven years' immersion in salt water; but they were, nevertheless, useful. After careful comparison and study, the plans were redrawn in a drawing-office on the site, and the instructions and directions translated. With this additional valuable information at the firm's disposal, the work of salving was simplified to a great extent, and more rapid progress was made possible.

In particular, the flooding valves—the exact position of which had been until then unknown—were located, and they were closed systematically by divers who worked inside the ship by the aid of powerful submarine lamps. We may mention that the supply of air for the divers and current for the under-water lamps was assured from two independent installations, one on the pontoons, and a supplementary installation on one of the upper decks of the *Hindenberg* herself. The work of patching and sealing

the various openings occupied close upon five months. In most cases, other than those where wooden plugs could be conveniently employed, specially built-up wooden patches had to be constructed, and according to the position and size of the patch, wood planks varying in thickness from 1 inch up to 6 inches were employed.

In applying such patches, ventilating louvres and other complicated constructions were cut away under water until a satisfactory jointing surface was obtained. Again, for many of the larger patches strongbacks and supporting girders had to be arranged for and placed in position. The water-tight joint between the hull and the deck was in nearly all instances made by a pad or "pudding" of oakum, covered with a layer of canvas. Before finally screwing down, the surface of the patch and the hull was thickly coated with tallow, but it was quickly found that this material was at once eaten away by shoals of small fish. The simple and ingenious expedient of mixing a little Portland cement with the tallow was resorted to, and it was found that the joints remained untouched, and set quite hard under water.

The Pumping Operations

As soon as the patching of the ship was well advanced the question of the sequence of pumping operations had to be considered. The pumps employed may be conveniently divided into two classes. First, those which were self-contained and driven by oil engines, and secondly, those which were worked by power supplied from generating plants fixed on the surrounding pontoons. Among the former class were several oil engine driven 12-inch Conqueror pumping sets by W. H. Allen & Co., Ltd., of Bedford, and others by Drysdale & Co., Ltd., Yoker, Glasgow, and Lindsay, Swan & Hunter, Ltd., of Newcastle-upon-Tyne. The pumps of the second class consisted mainly of a series of twenty or more 6-inch submersible pumps, which were built by Submersible Motors, Ltd., of Southall. These pumps proved particularly useful throughout the salvage operations on account of their flexibility. They were connected to the generating plant on the pontoons by cab-tired sheathed cables, and current was supplied by alternating-current generators driven by belting from steam engines, the steam being supplied by the two water-tube boilers which failed at the critical moment when the maximum pumping power was required.

As the top deck of No. 2 turret was just above high water even at spring tides, it was decided to make that turret the starting point of the operations. All machinery was removed from the center of the turret, and as the water was lowered by pumping, all internal hindrances were cut away, so that a clear passage right to the bottom of the ship was given. By using this passage,

it became possible to place the submersible pumps at the lowest possible level in the ship, right at the beginning of pumping operations. On the occasion of our visit, preliminary pumping trials were in progress, and for this purpose two 12-inch pumps were placed on the turret deck, with their suction pipes in the turret pump, and six submersible pumps at the bottom of the ship. The total output corresponded to 3,600 tons of water removed per hour. Before these trials, all the doors in the forward compartments of the ship were lashed back in an open position by divers, so that there was no possibility of bodies of water being imprisoned in compartments and so upsetting the trim of the vessel, and giving rise to undue hull stresses. In order to gauge the fall of water over the whole fore part of the ship, and to provide air for the empty compartments, a wooden trunk was built over a hatch at the forward end of the ship.

Arrangements were also made to protect the deck openings to prevent water being shipped when the vessel took an extreme list. About the middle of August definite attempts to raise the vessel were made, and she was lifted, both at the bow and the stern ends. It was found that the ship had settled down on a mass of rock, but fortunately the hull had not been pierced. When she was raised partially above water—the interior was carefully examined, and it was found that practically the whole of the water-tight bulkheads were pierced—in some instances, owing to corrosion, and others, no doubt, by reason of the tremendous inrush of water when the vessel was originally scuttled. This being so, when the distribution of the pumps was not quite balanced, the ship took on a natural list to port, which tended to increase as the water from the various compartments drained to the port side. Efforts to counteract this list, which were partly successful, included the securing of tackle to the mast heads, and fastening hawsers to the pontoons or to sunken destroyers which were placed at suitable points.

Port lists from 20° to 30° were safely carried, and at the end of August when the final lifting operations were begun, after pumping out the forward compartments of the ship, the list increased to a maximum of 35°. For a period of about one hour at high tide during one evening the *Hindenburg* remained in this precarious position. It was unfortunately not possible to right her and to bring her completely to the surface, owing to the completely unexpected failure of the tubes of the water-tube boilers which were supplying steam to the generating sets producing current for the submersible pumps. The most important and flexible pumping units were by this failure completely deprived of current, and the pumps which remained were totally inadequate to meet the pumping requirements which the righting operations demanded. At this critical time, a storm was also at its height, and seriously

interfered with the carrying out of the operations. When the boilers failed, the firm decided to seek to obtain steam to drive the engines of the generating sets from one of its large tugs which was moored alongside the lifting pontoon, but owing to the poor quality of the foreign coal and the fact that the ship was stationary, enough steam could not be raised.

After carefully considering all factors, it was reluctantly decided to sink the ship once again and to defer the final lifting operations until the spring of next year.

Further Work

The operations to which we have referred and which have taken place during the last two months, have all been carried out under the personal supervision of Mr. E. F. Cox, the managing director of the firm. On his recent return from Scapa Flow, Mr. Cox was good enough to give us some further information regarding the plans for the salvage work of the coming winter season. The four pontoons which were grouped around the *Hindenburg* have now been towed to Mill Bay, where they will be overhauled, the machinery put in order, and the lifting gear rearranged, so that when completed the two large pontoons will, when placed alongside the *Hindenburg,* have a steadying effect equal to a lift of about 24,000 tons.

Meanwhile, work has been begun on the upturned and nearly totally submerged battle cruiser *Moltke.* It is proposed to lift her by closing the apertures in the hull and introducing compressed air, thereby driving out the imprisoned water. When this is done, the ship will be transferred to shallower water, where she can be dismantled, thus providing work for the firm's shipbreaking department at Lyness Pier.

Reviewing the work of the past four and a half months, it seems to us that no mean task has been undertaken, and that even though deserved success was not at first attained, owing to the defects in boiler tubes referred to, the effort has not been without its compensations. When work is begun early next spring, it will mean that the final task of bringing the ship to the surface will be considerably shortened by the application of the knowledge and experience gained during the work of the recent short season of salvage operations. In a work of this magnitude, the loyal cooperation of both staff and men is most essential, and on the occasion of our recent visit, we were struck by the excellence of the team work, which, we believe, has played, and will again play no small part in the success of these salvage operations.

Submarine Will Last Despite all its Foes

Hector C. Bywater, Baltimore *Sun,* 7 Oct.—The *Oberon,* a new British submarine which was begun in March, 1924, will be com-

missioned tomorrow for trials. These will be of a preliminary character, as the boat has only recently been launched and is not yet ready for sea.

She is the second undersea boat to be built for the British Navy since the war, and is of interest as representing the standard type of "overseas," or long-range patrol submarine evolved by British construction in the light of war experience. The Admiralty has released no information about her except that she has a displacement of 1,480 tons on the surface and 1,750 tons when submerged.

She is, therefore, considerably smaller than the first British post-war submarine, the *X-1*, of 2,780 to 3,600 tons, which is about to make a practice cruise after another refit in dockyard. This gigantic submarine has already cost about $5,000,000, and has yet to prove that she is worth her cost. Professional opinion doubts the utility of such large vessels, and it is significant that the *X-1* design has not been repeated.

The *Oberon* is the first of a group of twenty-four submarines authorized under the post-war naval program, six of which are to be laid down this year, six more next year, six in 1928, and five in the following year. They are officially classed as "overseas" boats, though under the American system of nomenclature they would be designated fleet boats. Provision is also made for beginning in 1929 a fleet submarine, which will presumably be larger than the "O" class.

In the light of what was said at the Washington Conference by British delegates, the provision of so many new submarines for the British Navy may impress foreign observers as an inconsistency. Lord Balfour and Lord Lee both declared that submarines were practically useless for legitimate naval warfare, and only dangerous when employed illicitly as commerce destroyers. As I remarked in *The Sun* at the time, the British naval officers who were present must have doubted their ears. None knew better than they how valuable our submarines had proved during the war.

As soon as the armistice took effect the officer in command of the submarine service, Rear Admiral S. S. Hall, addressed a message to his command, in which he said: "Submarines were the first at sea on the outbreak of war, they have been continuously in action while it lasted, they will be the last to return to harbor. You have established a magnificent record of strenuous and gallant service, of clean fighting and devotion to duty that must always be a source of keen satisfaction to you for the rest of your lives, as it will be a great tradition to hand down to those who follow after you." Such was the British Navy's verdict on its submarines.

Apart from offensive operations—in the course of which they torpedoed six of the largest German capital ships, destroyed fifty-

four other enemy warships and 274 auxiliary vessels—they maintained a continual watch on the German coast, a watch so vigilant that no important movement by enemy shipping escaped their observation. No surface craft could have carried out this highly important duty.

It is but just to add that the German U-boats, on their part, were not always engaged in sinking merchant shipping. They took a heavy toll of Allied warship tonnage and their presence in the various war zones was a source of grave embarrassment to Allied naval plans all through the struggle. Though they never succeeded in torpedoing a grand fleet battleship, they compelled that force to steam at high speed and pursue a zigzag course whenever it put to sea, a method of travel that involved very heavy fuel consumption and a consequent restriction of cruising endurance—a serious disadvantage from the military point of view.

At a critical period of the Dardanelles campaign German U-boats intervened with telling effect. After they had sunk two British battleships in quick succession the whole Allied fleet withdrew to a fortified anchorage, leaving the troops ashore without the support of naval artillery. Had the Turkish command known how to take advantage of this opportunity, a crushing disaster might have overtaken our army in Gallipoli.

It is still a moot point whether Germany, by concentrating her submarines against the British fleet instead of using them as commerce destroyers, would not have achieved more decisive results. There is scarcely any doubt that the former course of action, by rendering the North Sea untenable for Allied warships, would have made the British blockade exceedingly precarious and might even have reduced it to a farce. It was as well for us, perhaps, that the German high command became obsessed with the idea of wholesale commerce destruction as a short cut to victory.

I have never been able to understand why some British publicists should continue to deny the military value of submarines. Do they really suppose that foreign naval experts are simple enough to accept their arguments in preference to notorious facts? To pretend that the British Admiralty is opposed to submarines, not only because they are dangerous to British floating trade, but because they are worthless for legitimate war operations, is simply absurd. Facts and figures tell a very different story.

Britain ordered her first submarine in 1901, at a time when France was building these vessels by the dozen. The British Navy wished to have submarines of its own in order to study methods of defeating the new and insidious menace to the battleship. But no sooner had it acquired submarines than it discovered their offensive and defensive value and started in earnest to develop them on its own account By the time that the German war broke out no fewer than a hundred submarines had been built in England.

If they failed to make good during the war, how are we to explain the fact that 157 new British submarines were built or ordered in the war period, and that the building of submarines was never suspended even in the critical year of 1917, when the cry was all for new mercantile tonnage and destroyers? It is quite evident that three years of war experience had shown the submarine to be absolutely indispensable.

The submarine has come to stay. Of that there is no question. Restricted it may be; abolished never. In common with every other serious student of history (naval and otherwise), I disbelieve in the practical value of parchment as a deterrent to the use or abuse of any weapon by a belligerent who sees a definite profit in wielding it in the most effective way.

If anyone supposes that the anti-submarine propaganda of recent years has had the least result, he need only study the current building programs of the naval powers. He will then learn that submarines outnumber all other craft, and that 140 of these boats have been laid down or authorized by the six leading powers during the past few years.

English Navy Short in Aviation Strength

Hector C. Bywater. Baltimore *Sun,* 16 Oct.—Interesting data on the present strength and organization of the air force attached to the British fleet are published in the latest issue of the official *Navy List.* Although the naval air arm is nominally under the control of the Air Ministry, the navy appears to enjoy a fairly free hand with regard to the disposal and operation of aircraft assigned to it

The great majority of the pilots, and practically all the observers, are naval men. The aircraft-carrying ships are, of course, on exactly the same footing as other vessels of the navy, and it appears that members of the Royal Air Force who may be serving in these ships are for all practical purposes subject to naval discipline. Good will, tact, and common sense seem to be smoothing out the anomalies inseparable from a system of divided control, though the navy remains convinced that its aviation service will never be brought to full efficiency while that system endures.

What may prove to be the initial step toward emancipation was taken early this month, when the Admiralty decreed that all officers and men of the navy are liable to be sent up for casual flights in aircraft in case of necessity.

Subject to air military supervision, the naval air section is directed by an Admiralty bureau presided over by Captain C. P. Talbot, Royal Navy, and a staff of four other officers. The "fleet air arm" consists at present of nineteen flights, twelve of which are in home waters and the remainder on foreign stations.

Fourteen of these flights are accommodated in aircraft carriers, the others operating from shore stations. Three aircraft carriers are now in commission, the *Furious* with the Atlantic fleet and the *Eagle* and *Hermes* in the Mediterranean. Two flights are also carried in the cruiser *Vindictive*, which has a catapult and other special aviation equipment. The carriers *Argus, Pegasus* and *Ark Royal* are in reserve, the two latter being obsolete.

The light battle cruisers *Glorious* and *Courageous*, each of 18,600 tons and 31 knots, are being converted into aircraft carriers. Upon their completion the British Navy will possess five efficient carriers ranging from 10,550 to 22,600 tons, two steaming at 24 to 25 knots and the other three at 31 knots. The *Argus*, a 20¼-knot ship, will be available for second-line duty.

The *Furious* may be regarded as the most powerful and effective carrier now serving in the navy. Her complement includes eighty-one line officers and nineteen officers of the Royal Air Force. Six flights of airplanes are borne in the ship, representing five different types, viz.: Flycatcher, Blackburn, Bison, Fairey 3d and Dart, each flight having a force of seven pilots, five of whom are naval officers. The commanding officer of the ship's aircraft is a wing-commander, Royal Air Force. Thirteen of the ship's line officers have qualified for duty as observers in airplanes, bringing the number of officers on board (Navy and Royal Air Force) who are experienced in aviation duty to a total of sixty-three.

The *Eagle* carries four flights of machines, thirty-nine pilots, and eleven observers. The *Hermes* has two flights, twenty-two pilots and six observers. The *Vindictive* also is credited with two flights, but at present has only five pilots and three observers on her books. With an average of six machines to a flight, the four vessels named would carry a total of eighty-four airplanes.

No information is published as to the number of machines carried by battleships and cruisers of the fleet, but it is believed to be very limited, the American practice of allotting aircraft to all the larger combatant vessels not having been adopted on anything like the same scale in the British service, though its merits are obvious.

In addition to the naval aircraft proper, a number of Royal Air Force units have been detailed for naval cooperation and training. A coastal reconnaissance flight of five boat-planes is maintained at Calshot to supplement the naval patrol forces on the south coast. At the Leuchars base in Scotland three training flights are in commission for the use of the navy, consisting respectively of six fighters, six spotters and four scouts. Distributed between Gosport, Calshot and Lee-on-Solent in southern waters are five other training flights for naval use, most of these machines being

flying-boats and torpedo-planes. A Royal Air Force flight of seaplanes is also attached to the Mediterranean fleet base at Malta.

In all-round efficiency the British naval air arm is second to none, say competent judges. Thanks to the three big carriers already in service, ample opportunity is given for practicing deck landings at sea. This feat has now become a matter of routine, and the degree of skill on the part of the pilots is made evident by the infrequency of accidents. Some three weeks ago an airplane, after making an excellent landing on the deck of the *Furious,* slithered over the side and fell into the sea, one of the three men on board being drowned. This, I believe, is the first fatal mishap of the kind which has occurred for several years.

But if the quality of the fleet air arm is up to the highest standard, its strength leaves much to be desired. Although the British Navy is two-fifths larger than the Japanese, the latter, according to reliable intelligence, has an air force of greater dimensions. Japan, in fact, is reported to possess 148 navy airplanes in commission and 305 in reserve. Published figures give the British Navy only 116 active and about the same number of reserve machines. The United States Navy has 218 active and 180 reserve planes.

In proportion to its size the British fleet is, therefore, distinctly weak in aircraft, and in view of the important rôle that air power seems destined to play in future naval operations this weakness is a serious matter. It might prove a crippling handicap if the fleet had to fight in narrow waters, such as the North Sea, the Baltic or the Mediterranean, where, owing to the comparatively short distance from coast to coast, land aircraft of the most powerful type could be utilized to attack warships.

Some critics declare that if the annual appropriation for the Royal Air Force were wisely expended, the force of aircraft now attached to the navy could be greatly increased. It is complained, however, that an exorbitant percentage of the money is swallowed up by ground establishments and non-effective services. Be that as it may, there is little doubt that the divorce of the navy and army air sections from Air Ministry control would tend to a more economical and more efficient system of defense.

At the same time there is a strong case for retaining an independent air force for the protection of home territory. If the entire force of aircraft were divided between navy and army, it is quite possible that neither service would accept responsibility for defending the country against air raids in time of war. Each would probably argue that all its aircraft were required exclusively for naval or military operations, as the case might be. For this reason the retention and further development of the independent air force seems to be assured.

Threatened Dockyards

Naval and Military Record, 22 Sept.—We have heard no more regarding the disquieting hints in Parliament during the debate upon the closing down of Rosyth and Pembroke to the effect that other economies of the same kind were contemplated, but we fear that it will prove a mistake to let this silence produce an impression that retrenchment in the home dockyard organizations is finished. The steady curtailment which is going on in the size of the reserve fleet is an ominous symptom in relation to the future of the Royal Dockyards, for with an ever-decreasing demand for accommodation, and a correspondingly smaller volume of maintenance work, the economist will inevitably be seizing upon the question of redundancy again sooner or later. The one bright spot in the outlook for the three principal dockyards is in the assurance of a program of warship construction for the next four years, and although Chatham continues to be threatened by the prophets it is very improbable that the Admiralty will sanction any drastic step in connection with that yard so long as they can provide work to keep it going.

Devonport and Portsmouth may view the future with equanimity. So long as the British Navy goes on these two dockyards will go on. Of course, they will have their lean times, as has happened before in their history, but one encouraging factor to be borne in mind is that there is an "irreducible minimum" in dockyard administration below which it is impossible to go without destroying the whole standard of efficiency. Admiral Sir William Henderson, one of the ablest dockyard administrators of modern times, laid it down that there must always be a sufficient elasticity of man-power to permit of the easy mobilization of full resources in the event of a period of national stress. It may be true that we have lived into an era when the prospect of a period of national stress appears infinitely remote. But this only affects Admiral Henderson's doctrine in the matter of degree. A permanently smaller navy may justify permanently smaller establishments in the auxiliary organizations, but there must always be maintained the same relationship between the capacity to promptly develop to a full utilization of all the resources and the extent of these resources for war purposes.

Singapore

Naval and Military Record, 20 Oct.—The news that the Admiralty has invited tenders for a great floating dock for Singapore merely confirms general expectation. It is an open secret that various modifications have been introduced into the original scheme for the development of this port into a first-class naval base, and while large permanent works will still be undertaken—are now being undertaken, in fact—these will not be so extensive

nor so costly as at first projected. It will still be a battleship base. But the natural geographical advantages of the place render it peculiarly suited to the use of floating docks instead of necessitating the very much more costly construction of masonry basins.

The long, narrow peninsula terminating at Johore would make land attack very difficult since the approaches could be effectively commanded from the sea. The naval works are on the inner side of Singapore Island, so that attack from sea would not be a very simple matter. Apart from the fact that floating docks are more susceptible to destruction by bombardment than permanent graving basins, they are in every respect quite as effective.

Probably the truth is that the government feel that the policy to which they are committed with regard to Singapore is rather inconsistent with the general movement towards limitation of naval armaments now in progress at Geneva. The Singapore scheme is not due to materialize for another nine years, and during that time much may happen. The naval point of view, of course, is that we must proceed along normal lines of development despite all pacifist talk until such time as definite international agreement may become a *fait accompli*. The submarine, the contact mine, and the aircraft render any attack upon a naval base a very much more hazardous undertaking than it was.

It is probably true to say that at the present time the Admiralty have no definite strategical scheme in view in connection with Singapore when it is completed. The fact that we are developing a battleship base in the Pacific does not necessarily mean that we shall permanently station battleships in the Pacific. But in view of the vast interests which have to be guarded in the Antipodes, it is obviously essential that we should possess the means for maintaining a powerful fleet in those waters should necessity arise. At present we could not undertake any battleship operations east of Suez. Hong-kong Dockyard is adequate to dealing with the cruisers of the China squadron, but it could not take a dreadnought, and under the Washington Agreement we are debarred from extending it.

"R-33" As Airplane Carrier

London *Times*, 22 Oct.—A Service single-seater fighter was successfully launched today from the *R-33* while the airship was 2,000 feet over the Pulham station, the whole operation being carried out with a precision that was distinctly significant. A second fighter was later released at Cardington airdrome ninety miles away; so that for the first time in history two aircraft were carried under, and released in two separate areas from an airship in one flight.

The more intricate problem of re-hooking standard Service airplanes has yet to be solved before the full value of airplanes as

a defensive and offensive adjunct to the airship can be secured. There is no reason, however, to suppose that once research begins in earnest this phase of the use of an airship as an airplane carrier will not be achieved.

In any case today's experiment represented a distinct step forward, as the *R-33* came out of her shed here in the early morning with two fighting aircraft, each weighing over a ton, suspended from her, and so far no airship has ever carried more than one airplane and that not of anything like the same weight. The two machines, standard Grebe fighters, were slung below the broad underside of the airship, one between the control car and the first two engine nacelles and the other between the latter and the rearmost nacelle. Each machine was held by one center fitting on the top plane above the center of gravity, and two struts from the airship each coming to a point on the wings over the outer strut fitting on the front spar. Another strut to a point half way along the fusilage held the airplane rigid by a three-point compression against the pull of the central fixing. Here a quick release gear was under the control of the pilot, so that he could drop clear away merely by pulling a lever. A hole in the airship gave access by a rope ladder to the cockpit, and a flexible tube enabled a Bristol gas starter in one of the engine nacelles to be connected to the airplane engines for starting purposes.

Flying Officer R. L. Ragg and Flying Officer C. Mackenzie-Richards, both Royal Air Force pilots attached to the experimental staff of the Royal Aircraft Establishment, Farnborough, were detailed for the airplanes, and boarded the airship in the hangar with Group Captain P. F. M. Fellowes, Director of Airship Development, Wing-Commander W. L. Welsh, of the Flying Operations Section of the Air Ministry, and Mr. W. Whately Smith, an officer of the Air Defence Experimental Establishment, Biggin Hill, who was to carry out acoustical experiments in the air.

Major G. H. Scott, in charge of airship flying and training, was in command of the *R-33*, and had with him Squadron Leader R. Booth as his second officer, Flight Lieutenant Johnstone, navigator, and Captain W. Meager, third officer. When at 8:45 A. M. the *R-33*, manhandled out of her shed, gracefully floated up into the air she carried a total personnel of thirty-five people, plus nearly 2½ tons of suspended aircraft. For nearly an hour she cruised around the airdrome at a height of 2,000 feet, a picture of smooth and easy motion, with the two airplanes, very small now in comparison with the ship, merely incidental fighting gear under her hull. Then the propellors of the Grebes could be seen slowly turning, under the pressure of the mixture from the gas starter, and the rearmost machine, in charge of Flying Officer Mackenzie-Richards, soon began to run under its own power. The other refused to function independently and this led to only one aircraft being dropped at Pulham.

Airplane Soon Under Control

The essential condition to a successful release, at any rate with the present gear, is that the airship should be moving at a speed somewhat below that of the airplane, so that the latter should drop at once clear of the larger vessel. Everyone watched with close attention as the airship came over the airdrome to see if the Grebe fell away in a dive and to ascertain how quickly the pilot could gain control. Actually the operation was so smooth that the airplane merely parted company with the ship and flew away at an angle of 45°, apparently under control from the moment it left the ship. In fact, it was learned afterwards, the controls became fully operative after a loss of 100 feet in height and, aided now by full engine power, the pilot immediately turned to starboard, executed a half roll, and then carried out a series of acrobatic maneuvers from sheer joy, or so it seemed, at release from a temporary bondage.

The airship with the second airplane still suspended, then set off for Cardington which was reached at 11:40 A. M. Here Flying Officer Ragg, whose engine was now running, left the ship as easily as his companion had done at Pulham, and landed. The ship afterwards carried out the acoustic experiments, which consisted in detonating charges of powder and measuring the time taken for the sound to reach the ground and be reflected to the ship. By this means the height of the ship above the ground can be estimated, and for certain navigational purposes the practical application of this method may be very valuable. The experiments proved eminently satisfactory, and at their conclusion the *R-33* was berthed in the big hangar at 2:10 P.M. She will remain there until the Dominion Prime Ministers' visit to Cardington, and will then return to her normal station at Pulham.

As a matter of historical interest it is worth recording that it was in 1917 or 1918 that the first experiment in dropping an airplane from an airship was carried out at Pulham. The *R-29* was used, and in the first instance a Sopwith Camel was dropped without any pilot on board. The controls were set and locked, and the experiment was so successful that the machine landed itself with no more damage than a wrecked under-carriage. Encouraged by this, the authorities decided to make a release with a pilot in the machine, and a second Camel was dropped with Flight Sub Lieutenant Keyes, who is now dead, as the pilot. Further experiments were under consideration when all airship development was suspended, and now, though the future of *R-33* has not been settled, her age and general condition make it likely that any new experiments of magnitude will wait until the new airships, which are radically different in construction and designed with a better appreciation of the aërodynamic forces involved, are in service.

FRANCE

Our Naval Program

Le Yacht, Journal de La Marine, 9 Oct.—(Translated by Assistant Professor Henry Bluestone, U. S. Naval Academy.)—

In voting the laying of keels proposed by the government, between July 1, 1926, and July 1, 1927, the French Parliament has shown its intention to continue the work begun by the Act of April 18, 1922, for the reconstruction of our navy.

This continuity of view—which deserves to be pointed out the more so because for a long time those responsible for the direction of our naval affairs could be reproached for its absence—assures the progressive execution of the general plan prepared by the ministers who succeeded each other at rue Royale from 1919 to 1922, a plan deposited on the desk of the Chamber of Deputies in 1923, and modified the year following. This plan has not become the subject of public discussion, but the parliamentary committees have studied and approved it, and, if they made any modifications in it, it was only to raise the figures relative to certain categories of ships.

In round figures, the tonnage provided for by it is as follows:

Ships of the line, 175,000 English tons;
Aircraft carriers, 60,000 English tons;
Light surface ships, 360,000 French tons;
Submarines, 96,000 French tons;

And the special ships necessary for supplying this fleet, for aëro-navigation, for coast defense and for the accessory services in time of peace or war.

It is to be noted that the first two figures are expressed in English tons, because they were fixed by the treaties of Washington.

As to the other two, the one referring to light ships was fixed, in 1921, by the superior council of the Navy after a careful examination of our needs; the item concerning submarines, fixed at first at 65,000 tons by the original plan of the government, has been increased 48 per cent by the naval committee of the Chamber of Deputies in 1923.

The same committee, studying more recently the plan as a whole, has been led to estimate the tonnage of light surface ships that seemed indispensable and arrived at a total of 390,000 tons instead of 360,000 tons, basing its action on the following reasoning:

The Treaty of Versailles permitted Germany to maintain eight ships of the line of 10,000 tons, which will be allowed to be cruisers of the maximum type of the Conference of Washington when Germany replaces its present old battle ships. This figure of eight cruisers of 10,000 tons is therefore the least that we can

admit for our fleet in the Atlantic and the English Channel. We must have as many for the Mediterranean and five more in distant regions (it is one half of what Great Britain maintains permanently in distant seas). That brings the figure up to 210,000 tons for cruisers.

Similarly, the Treaty of Versailles authorizes Germany to possess light cruisers and destroyers with a total tonnage of 64,000 tons. The defense of our home coasts (which are more extensive and more vulnerable than those of Germany) could not be assured if we did not likewise have about 65,000 in torpedo boats and destroyers in the Atlantic and an equal tonnage in the Mediterranean. If we add to that 50,000 tons of ships of the same nature for the protection of our colonies, that will make 180,000 tons of torpedo boats and destroyers which, with the 210,000 tons of cruisers form a total of 390,000 tons of light surface ships.

As to submarines, the same committee estimates that their tonnage must not be less than half of that provided for torpedo boats and destroyers, that is to say, 90,000 to 100,000 tons.

In such matters, there is evidently nothing absolute, and the reasoning which we have reproduced has perhaps a mathematical appearance that is not perfectly suitable to discussions of this nature. It may be said that the superior council of the Navy, in deciding upon the figures proposed used documents known to them alone, and that their authority must make their opinions acceptable such as they are given. But it must be noticed also that the continuous increase of foreign armament in the Mediterranean on both sides of our Provence-Algeria junction line is a fact that we cannot neglect to take account of, and that the 360,000 tons of light ships asked for by the superior council of the government represents only a minimum. This minimum ought to be exceeded to the full measure permitted by the available financial resources of the country in years to come.

We shall recapitulate the construction decided upon by successive acts voted since 1922:

The one of April 18, 1922, provides for: three cruisers of 8,000 tons, six destroyers, twelve torpedo boats, six submarines of first class, to which it is well to add six submarines of the second class for coast defense (not forming part of the program of the high seas fleet), and the transformation of the battleship *Bearn* into an airship carrier.

The Act of June 30, 1923, provides for: three submarines of first class, six submarines of second class, six torpedo boats.

The Act of July 13, 1925, provides for: one cruiser of 10,000 tons, three destroyers, four torpedo boats, seven submarines first class, two mine laying submarines, one surface mine layer, one aëronautic transport.

In the budget of 1926 are included the necessary appropriations to begin four submarines of second class.

Finally, the last act voted includes: one cruiser of 10,000 tons, three destroyers, four torpedo boats, one cruising submarine, five submarines of first class, one mine laying submarine, one supply ship of submarines, two tankers, one graduate school ship for junior officers.

That represents a total of ninety-one warships, the keel of which will be laid during the five-year period from the summer of 1922 to that of 1927. It is a considerable effort rendered necessary by the long suspension of naval construction during and since the war, but which, evidently, could not be considered as threatening by anybody, since it is not a question of reinforcing our fleet but of replacing units some of which have already disappeared and others are about to be struck off the list on account of their age which exceeds the limits allowed by any navy.

In order to realize how these measures assure the execution of of the naval program accepted by the government and both chambers, en bloc, the tonnage of the ships the keels of which are laid each year is as follows:

In 1922: 55,800 tons of light surface ships; 6,800 tons of fleet submarines; 3,600 tons of coast submarines.

In 1923: 3,400 tons of fleet submarines; 3,600 tons of coast submarines.

In 1924: 30,000 tons of light surface ships; 3,000 tons of fleet submarines.

In 1925: 25,000 tons of light surface ships; 12,100 tons of cruising (fleet) submarines; 18,000 tons of special ships.

Finally, in 1926: 25,600 tons of light surface ships; 11,300 tons of cruising submarines; 22,800 tons of special ships; 2,400 tons of coast submarines.

It will be seen that for the light surface ships the keels of which are to be laid in 1926 the figures are as high as in preceding years. For submarines, the tonnage of 1926 is about equal to that of 1925. For special ships the tonnage exceeds appreciably that of previous years. But it is to be noted that the construction of such ships was begun only in 1925. Proceeding with greatest haste, the entire available tonnage had been reserved for battle ships during the first three years. It is further to be noted that the series of 1926 includes, up to the tonnage of 11,000, tankers the cost of which is clearly below the average of the price of other categories of ships.

In recapitulating the above figures, we see that the keels laid from 1922 to 1927, that is to say, in five years, will include:

Seven cruisers (three *Duquay-Trouin,* two *Duquesne,* two *Suffren*);

Twelve destroyers (six *Jaguar,* six *Guepard*);

Twenty-six torpedo boats (twelve *Bourrasque,* fourteen *l'Adroit*);

One cruiser submarine;

Twenty-three submarines of first class (nine *Requin*, two *Redoubtable*, twelve *Pascal*);

Three mine laying submarines (three *Saphir*).

We do not include in these totals either the submarines of second class intended for coast defense or the special ships, these two categories being outside of the program of the high seas fleet.

Estimated on Washington tonnage—that is to say including neither fuel nor reserve water for motors—the ships we have just enumerated represent:

125,000 tons for light surface ships;

35,000 tons for submarines of the high seas.

Let us now compare the rate of keel laying to that which is necessary in order to assure in a permanent manner the renewal of a fleet equal to the one provided for by the plan for our naval status, assuming that such fleet has previously been built.

The age limit of light surface ships may be fixed at an average of sixteen years (it is seventeen years for cruisers, fifteen for torpedo boats and destroyers). Accordingly, in order to construct or replace 390,000 tons in sixteen years each year keels must be laid on an average of:

$$390{,}000 \div 16 = 24{,}000 \text{ tons},$$

or, in five years, 122,000 tons.

We shall therefore have taken, from this point of view, a slight step in advance of 3,000 tons, or a little less than 3 per cent.

As to submarines, their regulation lifetime is twelve years. In order to replace in that period 96,000 tons provided for by the naval status, it would be necessary to order each year

$$96{,}000 \div 12 = 8{,}000 \text{ tons},$$

or 40,000 tons in five years.

Now, from 1922 to 1927, we shall have begun only 35,000 tons. We are, therefore, in that respect, 5,000 behind or 12 per cent.

On the whole, the effort made from 1922 to 1927 will be somewhat below the average effort strictly required to assure the renewal of the naval status.

However, in the foregoing calculations we included only light surface ships and fleet submarines. The plan of our naval status includes 175,000 tons of ships of the line and 60,000 tons of airship-carriers which the Treaty of Washington authorizes us to possess. The regulation life of ships of these classes is twenty years. On the whole, therefore, it would be necessary to renew in twenty years, for the two categories, a tonnage amounting to

$$175{,}000 + 60{,}000 = 235{,}000 \text{ tons},$$

which represents, for each year, the laying of keels on an average of

$$235{,}000 \div 20, \text{ or } 12{,}000 \text{ tons about.}$$

Adding the laying of these keels to those enumerated above, the effect would be to increase by about one third the annual appropriations for our naval construction.

Be it said, under the present conditions, there is little probability that any government would ask Parliament for this supplementary sacrifice. The laying of keels of cruisers properly so called, that is to say of ships of 35,000 such as the English *Rodney* and the *Nelson,* ships of the line of the *Washington* type would have but few advocates among us. This question must be reserved until an increase in the known programs of the Mediterranean powers obliges us to consider it again, or until the conception of a ship of the line of less than 35,000 tons comes to light and appears feasible. For the present, the conclusion of this study is that the program tacitly accepted by the two chambers is being executed almost normally, but that it is important not to slacken the pace of construction which we have attained, on an average, since we have undertaken the rebuilding of our fleet.

New 8,000-ton French Cruiser

Marine and Motorship Builder, October, 1926.—The three new 8,000-ton French cruisers, built in accordance with the Law of April 18, 1922, have just been completed, and are now ready for service. These vessels, which represent quite a novel type of ship in the French Navy, are the biggest warships completed in France since 1914, and the most powerful units ever built in that country.

The *Lamotte-Picquet* has been built at the Lorient Naval Dockyard, and it is believed that she is the biggest ship to be built in a graving dock up to the present moment. The propelling machinery for the *Lamotte-Picquet* has been supplied by the Forges et Chantiers de la Méditerranée.

The *Primauguet* and the *Duguay-Trouin* were both launched from the Brest Naval Dockyard, the former being engined by the Chantier et Ateliers de Saint-Nazaire-Penhoet, and the latter by the Ateliers et Chantiers de la Loire.

The ships have the following principal particulars:

Length	175.30 m.
Breadth	17.20 m.
Draught	5.30 m.
Displacement	8,000 tons
Designed power	100,000 h.p.
Designed speed	34 knots
Cruising radius	5,000 miles at 15 knots

The armament comprises eight 155-mm. guns mounted in four twin-turrets, two at each end of the ship; four 75-mm. anti-

aircraft guns; and four triple 550-mm. torpedo tubes, two to port and two to starboard.

Propelling Machinery

The propelling machinery of the *Duguay-Trouin* has been constructed throughout in the works of the Ateliers et Chantiers de la Loire, and consists of four independent sets of Parsons steam turbines, each driving one propeller shaft. These four sets of turbines are located in three engine rooms. The forward engine room contains the two sets of turbines driving the wing propeller shafts, these sets being arranged symmetrically on each side of the center line of the ship. The turbines which drive the starboard inboard shaft are located in the intermediate compartment, while the set which drives the port inboard propeller shaft is fitted in the after compartment.

Each set of turbines includes, for ahead running, a high-pressure turbine which exhausts into a low-pressure casing, the latter exhausting into a condenser carried below the lower half of the turbine casing. Double helical gearing of the single-reduction type is provided for each shaft. Forward the high pressure turbine a cruising turbine is arranged, this unit driving the shaft of the high-pressure turbine through single-reduction gearing. The cruising turbine consists of a single impulse wheel, and is only used for ahead running at low speeds, a suitable disconnecting coupling being provided between the gearing driven by that turbine and the shaft of the main high-pressure turbine. The high-pressure turbine is of the single-flow reaction type, while the low-pressure turbine is of the double-flow reaction type. Steam is admitted to the center of the turbine, and exhausted at the ends, so that end thrust is almost completely balanced, and dummy pistons, which are fitted to the high-pressure turbine spindle, are rendered unnecessary. At the forward end of the low-pressure turbine a high-pressure astern portion is arranged. This is provided with impulse and reaction blading, and it is designed to exhaust direct to the condenser, no low-pressure astern turbine being provided.

Before entering the turbines, the steam passes through control gear which includes an ahead-running valve and an astern-running valve, both controlled by the same wheel. It then passes through a distribution box fitted on the high-pressure turbine casing, this box comprising a set of four valves, also controlled by the same hand wheel. The first valve controls the inlet of steam into the cruising turbine, corresponding to 1/11th of the maximum power, and to a speed of about 16 knots; the second valve controls the steam inlet to the first high-pressure expansion stage (corresponding to one-fifth of the maximum power); the third valve controls the steam inlet to the third high-pressure expansion stage (corresponding to one-half of the maximum power); and the fourth

valve controls the steam inlet to the fifth expansion stage of the high-pressure turbine (corresponding to the maximum power).

For astern running, steam comes from the control gear and is led directly to the low-pressure turbine. There are two directly-controlled valves fitted in the inlet pipe to the astern nozzles which enable steam to be admitted to a variable number of nozzles, according to the number of boilers working and hence to the quantity of steam available. The wheel of the control gear and that of the distribution box are fitted on a control board which also includes all control gear for the hand regulation of the throttle valve, and of the discharge valve to the condenser.

Each condenser is equipped with three air ejectors of the Maurice Leblanc two-stage type. Each condenser is provided with two air pumps, driven by geared turbines, each of these pumps being sufficient to ensure the maintenance of a sufficiently high vacuum in the condenser for low speed steaming. The circulating pump for each turbine is also driven by a geared steam turbine.

Steam is supplied to the turbines by eight oil-fired water-tube boilers of the small-tube type, working at a pressure of 18 kilograms per square centimeter (256 pounds per square inch). Each boiler has a heating surface of 1,100 square meters.

Trial Performance

The sea trials of the three cruisers included a six-hour run at full power, a twenty-four-hour resistance and consumption trial at 30 knots, and an eight-hour consumption trial at 15 knots.

The following are the results of these trials for each vessel, from which it will be gathered that while attaining a maximum speed of over 33 knots, these ships are capable of making continuous runs at 30 knots with a fuel consumption rate of only slightly over 800 kilograms (1,766 pounds) per mile:

	Duguay-Trouin.	*Lamotte-Picquet.*	*Primauget.*
Power trial:			
Speed on the measured mile, knots	33.60	33.04	33.066
Mean power developed during 6 hours, shaft horse-power	116,235	115,100	116,849
Mean fuel consumption per hour, kilograms	46,367	49,000	50,584
Resistance and consumption trial at 30 knots, during 24 hours:			
Consumption per mile, kg.	804	820	825.44
Consumption trial at 15 knots, during 8 hours:			
Consumption per mile, kg.	219.28	260	284.04
Distance necessary to stop ship when running at 20 knots, meters	425	600	550

(Calorific value of fuel oil used: 10,500 calories.)

Competitive Examinations for Admission to the Navy Academy

Le Yacht, Journal de la Marine, 18 September, 1926.—(Translated by Assistant Professor Henry Bluestone, U. S. Naval Academy.) With the publication of the list of candidates admitted to the Naval School as a result of the competitive examination for 1926, the Minister of the Navy made public several decisions concerning competitive examinations for future years. We have spoken in these columns about questions related to these competitive examinations on several occasions. However, these questions appear so important for the future of our navy that we believe it proper to return to the subject, particularly on the day on which the minister announces measures which, for the most part, satisfy the desires expressed by us in this publication.

It should be stated from the very outset that the competitive examination of 1926, which brought out more candidates than the preceding, was decidedly superior to them. We are led to see therein a double manifestation of the interest which part of French youth is beginning again to take in maritime affairs and likewise, no doubt, a return of confidence in the future of our navy, which seemed definitely sacrificed as a result of the naval agreements of Washington. Whatever may be the case this decided improvement had for its result that the Minister, after announcing that he would take eighty-five young men into the Naval School in 1926, has been able to admit ninety-five, and that if—as is probable if not certain—there are any resignations, it will be possible to fill such vacancies. Those who are interested in the Naval School will remember the unfavorable impression produced last year by the fact that certain candidates, having presented themselves to the examination without intending to enter the navy and having resigned as soon as they were admitted, had not been replaced, ostensibly because of insufficiency of the competitive examination. That will not be the case this year, and thus the "amateur" candidates, those whose aim is the École Polytechnique and who take the competitive examinations only for training, will do no harm to the others, who really seek to enter upon a naval career. Everybody will surely agree with us in thinking that it is only in these latter that we are interested.

The number of candidates admitted in 1926 is therefore appreciably greater than that of 1925; and the number of 1927 will, beyond doubt, not be smaller. The minister has fixed it at a minimum of ninety, and this manner of announcing his intention well indicates his desire to exceed that number, if not inconsistent with the results of the examination.

Three years ago, in discussing the list of naval officers in these columns, we pointed out that there was already a marked shortage and that that shortage would inevitably increase in proportion to the personnel fixed by the law in force, and, furthermore, that new law concerning the personnel would certainly require an ap-

preciable increase of the total number, at least so far as the lower ranks of officers were concerned. As we have pointed out, it is a direct consequence of the change in the composition of our navy, where there is an increase of small craft which, in proportion to their tonnage, require more important staffs than the big battleships.

That is why, if we wish to provide the necessary staffs for the new ships under construction, it is high time to see to it that the various agencies for the recruiting of officers increase their output.

Of these agencies, the Naval School must continue to be the most important. We must attract as many candidates as possible, in order to give a choice that will assure a necessary guarantee. And this is what has been the aim of the various efforts, made particularly since the war.

The change of program so suddenly decided upon in 1924 had no other object. It was hoped that, by requiring of candidates the same preparation as required of students of special mathematics classes who desire to enter the École Polytechnique, the level of examinations would be appreciably raised, and that these examinations would attract a large number of young men who, without having previously thought of entering the navy, would make it their career after passing the examination. We made a mistake. The adoption of a program based on that of the École Polytechnique necessarily had to have for its logical consequence the raising of the age limit which continues to be one year less for the Naval School. For excellent reasons there was no desire to agree to such change. The result was, on the one hand, that the immense majority of the candidates subjected to that intensive "grilling" showed itself to be very mediocre before the examiners and that the attendance was decidedly poor; on the other hand, the young men who were preparing themselves for the École Polytechnique and who passed the examination for the Naval School, having one more year before them to present themselves for the school of their choice, resigned in a body. The Navy, therefore, derived no benefit from this measure, the harshness of which, furthermore, alienated many families and was of a nature to discourage many from aiming at vocations. And yet, is it not the vocations that should be favored, even in preference to propensities for the sciences, when it is a question of a career so specialized as that of a naval officer?

For the examination of 1926, a transitory measure was adopted which consisted in replacing the program of the special class of mathematics, which was decidedly overloaded with science, by that of the special class of preparatory mathematics, the students of which, furthermore, have the same average age as the candidates for the Naval School. But that could be only a step; it was logical that we should come back to a special program for the Naval School, as we always had had, just as the École de Saint

Cyr, the École Politechnique or the École Centrale have theirs. Were we to take back the former program, the pre-war program? It had given satisfaction for several years, but it might be well to touch it up so as to answer the needs of future naval officers. In order to fix it in a truly rational manner, it was decided to appoint a committee composed of present and former commanders of the Naval School and the Post Graduate School (École d'Application) for junior lieutenants under the chairmanship of Rear Admiral Stotz, who commanded the *Jeanne d'Arc* from 1921 to 1923. This committee, whose capacity could not be put in doubt, was asked to determine exactly what subjects are to be taught at the Naval School and at the École d'Application, it being understood that the program of the latter was to be almost entirely practical and that even at the Naval School theoretical questions were to be studied only in view of their application. This double program definitely fixed, it became easy to conclude what program was to be fixed for the candidates at their examination for entrance to the Naval Academy. It is, after all, the same that we had before the reform of 1925, particularly with the reintroduction of history and geography. It is inconceivable how a sailor's education can be complete without them.

Desirous to avoid the criticism justly directed against his predecessor in 1924, the present minister of the navy did not prescribe for the examination of 1927, the adoption of the program that has just been elaborated. Next year, candidates will be examined in the same subjects as in 1926. It is only for the examination of 1928 that the new program will be put in force. It will result in an appreciable easing up in mathematics, certain parts of which though at present required, cannot be of any use to officers, whether they belong to the army or the navy, and likewise in chemistry, the program of which, as imposed on candiates these last two years, was entirely excessive. Thus we shall restore order in our household, and the error of 1924 will be corrected to the extent that it has been possible to do so.

What is particularly regrettable in these changes, when they are rushed through and do not answer the real needs, is the fact that there are private interests of an entirely honorable nature that are injured. Many young men who ardently desired to enter upon a naval career were prevented from doing so, without any benefit other than that of satisfying the *amour-propre* of some special mathematics students. Is it really well, at this time, to discourage good intentions when the government has so much difficulty in finding good servants and, particularly, devoted servants?

To mitigate the injustice resulting from the sudden change of program, special measures have been taken authorizing candidates refused in 1925 at the age limit to present themselves again in 1926. Fifteen of them have just been admitted, most of them with

good grades, and there is no doubt that the navy will find in them good officers, because their desire to serve it was great and they had to make a great effort. In fact, the decision to which we have just called attention was not made until February last, that is to say at the time when about half of the program had been studied in the preparatory classes. Candidates that had already adopted the new course deserve much credit, therefore, for catching up with their comrades. In view of the fact that the change made in the program in 1924 put many young men in a disadvantageous situation, the minister has just decided that, until the new program is adopted, candidates eliminated at the age limit would be authorized to present themselves again for examination: those refused in 1926 and 1927 can therefore present themselves for examination in 1927 and 1928, respectively. This decision will surely be well received by candidates in whom the taste for the maritime vocation is not coupled with an extraordinary liking for mathematics.

Furthermore, if we are well informed, the minister is willing to grant unlucky candidates a new favor, commencing with 1928. It is that of allowing them to present themselves once more for examination, provided they previously sign their enlistment as sailors of the navy. This would simply mean the application, in the navy, of a regulation that has always existed in the army for the École de Saint Cyr and the École Polytechnique. The question is still under consideration, but it is very probable that the decision will be such as we have just indicated.

It may be hoped that, if the number of candidates continues to increase (as it seems logical in consequence of the measures taken), the Naval School will be able to furnish to the navy annually about one hundred officers well selected and well prepared. But that will not be sufficient to bring back our staffs numerically to the strength necessary to carry out our naval program. We ought to graduate 120 officers annually, and this figure seems a little too high for present prospects. On the other hand, it is not desirable that all the officers of the same corps should have the same origin. It is well that a certain number of them should have gone through a particularly more practical preparation, as much so for the interest of the navy as for the interests of the officers coming from the Naval School. The principal of advancement by rank to the grades of officers will also be safeguarded provided officers of such origin are given sufficient scientific training so that they may not be found wanting under prevailing conditions of the profession.

The school for naval student-officers already exists at Brest, where it operates in the same places as the Naval School and the school for engineering student-officers. (We wish to point out at the same time the excellent effects of this organization which tends to suppress a form of particularism of which the navy suffered especially of late.) However, at that school the candidate

naval officers are so few that the school operates on almost nothing. It is a question of restoring life to it. The minister of the navy has decided to do so and is preparing the measures calculated to bring that result.

Such young men as are above the age of admission to the Naval School must not forget, in any case, that it is still possible for them to join that body whose career they wish to adopt. They have the opportunity to enlist as sailors of the navy, and announce their intention to prepare at the end of the school for student-officers. The minister has issued orders to all the services and aboard the ships that officers should look with favor on their efforts and even help them to prepare for their examinations. After two years' service, they can be admitted to the school, the number of whose students is not limited like that of the Naval School, and which assures them the same advantages of the career. They will only have an original delay of two years, which favorable circumstances may enable them to make up in the course of the years following.

After being reorganized, this school for marine student-officers should furnish annually from ten to fifteen officers. The completion of the figure of 120 indicated above would be expected from the reserve student-officers, which, as stated, can bring to the navy an element of high usefulness and excellent quality.

The total effect of these measures will be to fill immediately the gaps in the ranks of our staffs, and the future of the navy will be entrusted to officers sufficient in numbers and at the same time remaining worthy of their seniors both because of their scientific and professional merits, on the one hand, and their moral qualities and love of the profession on the other. Let us hope that the clear foresight that has begun to manifest itself may persist in this plan.

Navy Notes

Navy and Military Record, October, 1926—Good use is being made of Parliamentary vacations to forward the interests of efficiency. Ships in dockyard hands are being pressed forward with a regard to economy; trials of new units are being conducted more thoroughly than ever before; data, carefully collected and centralized, are being methodically embodied in new construction; and greatly improved designs of light ships, torpedo, and aerial craft, have been ordered. A noted specialist, Commandant Batsale, has been placed in charge of the Admiralty Scientific Research Department. To meet the growing need of naval officers, the patriotic Minister Leygues has decided on an increase of École Navale pupils. The energetic Admiral Pirot has been appointed to command the 8,000-ton cruiser division.

Ship Defense Against Aerial Attack

The aerial danger to ships in harbor and at sea is anew attracting the attention of naval experts, as the result of recent realistic experiments with up-to-date aerial machines and projectiles. It is realized that the anti-seaplane armament adopted for French *croiseurs légers* and flotilla units, that only comprises 75-millimeter guns of ordinary type, modified as to the mountings, makes up a defense totally inadequate against the deadly peril, and every day growing, that will threaten from the air the freedom of action and safety of war fleets. That flying machines will ultimately drive surface ships from the water, in cooperation with submarines is the bold forecast of air enthusiasm. Similar prediction, it will be remembered, was made some fifty years ago by the great constructor Dupuy de Lôme, the famed originator of the ironclad. War data throw imperfect light on the possibilities of airplanes in action against ships. Seaplanes of only half a decade since were practically harmless, constituting more an *épouvantail* than anything else; the few shells and bombs they carried were of the wrong sort, bomb dropping was then a mere game of luck; tactics of attack, especially group tactics, were mostly non-existant. These several vital desiderata to sea-plane efficiency have now been met, and, as a consequence, the aerial menace will follow the battleship or cruiser from the very beginning to the very end of the war, by night as well as by day, in harbor no less than at sea.

This means that sea power will be a small, doubtful asset if not supported also by air efficiency. Such being the true situation, no wonder the best brains of the service are centering their efforts round the questions of aerial tactics of attack and defense, two items, of course, closely interdependent and that need to be studied on parallel lines. To meet the new conditions of offense a novel system of training is necessary, together with new material. It requires only a moderate dose of imagination to foresee the extremely interesting developments likely to take place in that direction and that will revolutionize the science of strategy. For instance, long radius of action, ocean-going bateaux-volants of the Penhoet type, thrown into the war game, are seen to materially modify events as in the last war. There would have been no escape for the *Goeben* and *Breslau,* of Admiral Souchon, and ubiquitous German corsairs would have had a short career.

Three stages in the defense against airships, namely, to try and destroy them before they come within striking range, which is the job of battle planes mostly; to smash them by ship artillery as soon as they are within sight; to blind them, frustrate their blows, and minimize their effects by means of special shells, artificial clouds, ship zig-zagging maneuvers, and bombproof decks and screens. Well handled enemy bombing planes, quickly diving down or rising, circling at tremendous pace and suddenly slackening to aim and drop their deadly missiles, will be no easy targets.

Artificial smoke of various colors will limit visibility conditions, rendering accurate and safe maneuvering difficult and range finding practically impossible. Preventive protection will be best afforded by seaplane screens, adequately equipped and trained. Motor vedettes of 40 to 50 knots speed, mounting special guns with smoke shells and artificial cloud equipment will prove invaluable to fleets at sea; there will not be enough of them for barrage work. As to anti-aërial guns they need to be perfected and skilfully handled to be of any use against targets moving at a rate of one to two miles per minute. The new French *canon-auto matique anti-aerien* of 4-inch bore, to be fitted in new cruisers, is capable of launching a shower of over 3,000 pounds of steel and explosives per minute; it embodies the results of ten years' painstaking experiments.

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Minister Leygues has decided on a show-the-flag policy. The Baltic tour made by the escadrille under Captain de Pontevès (destroyers *Jaguar, Chacal, Simoun,* ocean submarines *Margouin* and *Souffleur*) has been successful from the training and diplomatic standpoints. A similar cruise is shortly to take place in the Adriatic, and the destroyers *Tiger, Panthère,* and *Lynx,* the *Narval* and *Requin,* submarines, are expected to be selected to that end. Later two cruisers of 8,000 tons will show the flag in American waters from which the Tricolor has been absent for many years. The 11,000-ton cadet cruiser *Jeanne d'Arc* is, after refit, to leave for a six months' Atlantic cruise, in the course of which the West Indies and Carribean Sea islands will be visited *en détail.* This is a return to past French traditions; the navy is anew to be treated as a world force and no longer as a shore day promenade concern, kept for the good of the postmilitaire publicans. This means a new era, favorable to recruiting and greatly to the honor of Minister Leygues, who understands that the secret of efficiency is to be found on the high sea.

A fourth French super-destroyer, the *Panthère,* has run through her official trials, on the Groix-Glénans base in the Bay of Biscay. She was constructed, together with the *Jaguar,* in Lorient Arsenal, where she was lunched in October, 1924. Originally intended to be ready in April, 1925, she has been delayed over fifteen months through modifications to her condensers and partial strengthening.

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The results of the *Panthère* were being awaited with all the more interest that she is a Breguet-turbined vessel, whereas the three sister ships now in service are fitted with Rateaus, viz., *Tiger* (now in the Mediterranean), *Chacal,* and *Jaguar,* flag-showing in the Baltic. It had been expected and even demonstrated on paper—that the performances of the *Tiger* would be excelled. Events have

proved otherwise. The *Panthère,* after doing excellent consumption and speed preliminary tests, only averaged 35 knots during her eight-hour full speed trial, which she started with an overload of nearly 270 tons. She may not have said her last word, though, and new screws may determine a change for the better. Of course, she is like her sister ships a remarkable sea boat, reliable for a continuous sea speed of over 30 knots, and all the same holds an honorable rank among the world's destroyers, remembering that French speed trials are stiff and the Commission des Essais unsparing in its appreciation.

* * * *

The extremely pushful naval policy of our *sœur latine,* Italy, is again well to the fore. The peninsula, that had not a single merchant ship of 10,000 tons register in 1914, is now easily outdistancing France. There are built or building only three French paquebot exceeding 20,000 gross tons, namely, *Ile de France* (building at St. Nazaire) of 41,000 tons; *Paris,* of 35,000 tons; *France,* of 24,000 tons. There are ten such mastodons on the Italian Navy list; *Conte Biancamano* (23,000 tons), *Conte Grande* (24,000), *Roma* (33,000), *Augustus* (33,000), *Saturnia* (24,000), *Vulcania* (24,000) a new liner for the Navigazione Generale Italiani of 45,000 tons, two more for Cosulich of 35,000 tons, and one of 30,000 tons for the Transatlantica Italiana. These splendid Italian liners mean an increment of naval stregth in several ways; they have been designed to carry guns, they will prove excellent auxiliary cruisers and troopships; their trained crews will prove available for manning warships; they will add to Italy's prestige and constructional and fighting resources. Such a rate of expansion is truly marvelous, and shows to what extent the peninsula has benefited by the war. Yet, without Mussolini, authority, and stability with competence at the head of affairs, it would have been impossible. France has far greater natural advantages, but as yet no governmental stability. Leadership is everything in peace, the same as in war. "An army of rabbits under a lion is more to be feared than an army of lions under command of a rabbit." (Napoleon *dixit.*)

The disquieting fact is that Mussolini means business and that retrenchment and goody-goody defensive ideals *à la Française* are totally foreign to his forceful character. He has replaced the ex-Kaiser on the European stage as "dry powder and sharp sword" orator, but with greater will and with a touch of personal heroism not to be found in the temperament of the ex-Kriegsherr. Tragedy may be with us before French people, absorbed by party strife and inclined *à re pas predre les Italiens au serieux,* are aware of it. That is the danger point; and a watchful, determined attitude of readiness for any emergency on the part of France might prevent incidents. Against Turkey as well as in the Corfu affair, and now

by her claims concerning Tangier, Italy has shown her navy exists, not only for eventual self-defense, but also and chiefly to vindicate what she considers as her rights to expansion, rights due to her prolific populations (43,000,000 against 37,000,000 Frenchmen) and to her activity and spirit of enterprise. Italians consider they have been wronged mostly by France and Great Britain, and that they have not their right share of Mediterranean islands and shores. They are, naturally enough, indignant at the thought of being shut up in the Mediterranean by the Gibraltar gate, and at the mercy of a foreign power. Of the two keys of that vital passage they think that one ought to be in their pocket so as to ensure the neutrality of the Straits in war time, and they will have no rest till that is obtained. A *politique de sentiment* as so skilfully played by M. Briand is highly distasteful to the land of Macchiavello, Cavour, Mazzinia, and Mussolini.

Viewing the prospects from a naval standpoint, the effective Italio-Spanish alliance changes altogether the balance of power in the Mediterranean. It means that French supremacy in the Western Mediterranean, that was again and again officially described as being vital to the safety of Algeria, is at an end for some time to come, at least. It means also a depreciation of stopping value of the Gibraltar gate and an all-round change in the strategic conditions of the Western Mediterranean. If the fighting efficiency of the Spanish Navy need not be exaggerated, it is nevertheless steadily progressing. A third 8,000-ton cruiser, *Miguel de Cervantès,* has just been ordered at Ferrol; another is to be built at Cartagena, three 36-knot and 1,700-ton destroyers are to be shortly laid down, without mentioning a new program of submarines. The destroyer division, under Rear Admiral Don Salvador Calvi, that has been touring round French and Italian ports, has produced an excellent impression. As to the Italian fleet, it is animated with the indomitable Mussolinian spirit, kept in a state of minute readiness, working hard, and strategically backed by a series of carefully selected points d'appui. Indeed, a new era is opening in the Mediterranean.

Le Yacht, 18-25 Sept.—[Translated by Assistant Professor Henry Bluestone, U. S. Naval Academy].—The Augustin Normand Yards and Works, whose old reputation is well established in the whole world, will proceed on October 6, 1926, to the launching of a submarine of 400 tons, the *Spindola,* constructed for the Lettish Navy. The launching will take place at 8:50 A.M.

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The squadron torpedo-boat *Tramontane,* one of the twelve of the first section of the naval program, is pursuing its tests with success. As is known, this torpedo-boat was constructed in the Gironde Yards, at Bordeau and, after successful preliminary tests in the roads of the Isle of Aix, when it exceeded 30 knots, it was

sent to our port to be officially received. It is a splendid ship, with a slender stem in cut-water form, which will easily exceed its 33 knots. It is 99.30 meters long; 9.64 meters wide, and has a draft of only 3.80 meters AR. Its displacement is 1,455 tons. The power of its motors which is to be 30,000 h. p. is calculated to give a speed of 33 knots. Its armament consists of four cannon of 130 mm.; one of 75 mm., arranged to fire at air ships; two triple torpedo tubes of 550 mm.

JAPAN

Naval Estimates

Japanese *Advertiser,* 28 Sept. Hochi.—The change of the Finance Minister having necessitated the redrafting of the plan for ship construction, the navy authorities appear to be fretful and restless. Let the report be what it will, it is necessary for them to seek a previous understanding with the Finance Minister in preparation for a decision upon principles relating to the naval estimates.

Shortly after his inauguration to the portfolio of Finance, the late Mr. Hayami was seized by illness, so the navy authorities had no opportunity to effect an arrangement with him in respect to the construction. Having been the Parliamentry Vice-Minister for Finance, Mr. Hayami might have had certain convenience in negotiating with the navy authorities on this important business.

Mr. Kataoka participated in the discussion of the plan, but merely as a cabinet member. He is an amateur in this respect, although he now holds the portfolio of Finance. This is, perhaps, why the navy authorities are anxious. However, the Premier and the Home Minister are fully experienced in naval estimates, and, accordingly, they have definite views. We are convinced that no serious dispute will arise between the navy and finance ministries.

Judging from present national finance, we do not see a way open for the government to accept the plan without alteration. The question is how the navy will seek a compromise with the finance ministry. During the fifty-first session of the Imperial Diet, the navy authorities assiduously strove to have the estimates of 320,000,000 yen recognized by the finance minister, but it was decided to build only four destroyers.

It is natural with the authorities charged with national defense that they wish to have as many ships as possible. They may not be overwhelmed by their ambition. Probably they are persuaded that their plan is absolutely necessary in the light of the formidable forces of others, but it must be borne in mind that efficient defense stands on the economic strength and the ideas of the nation concerning defense.

This is a great principle to be followed lest national defense be affected. Due attention must be paid to the economic strength

of the nation, but great care must be taken of the nation's idea about defense. The so-styled idea about defense is the willingness to bear the burden requisite for national safety. The nation must have a clear idea that defense is its own indispensable business. This knowledge will make it prepared to bear the burden.

The increase of warships will not assure the safety of the nation unless due care is taken respecting the preparedness and economic strength. This contention must be cautiously considered in renewing the arrangement with the finance minister. The nation is thoroughly alive to the importance of defense, yet it is doubtful whether the general public will accept the plan drafted by the navy authorities unconditionally.

Defective Air Corps

Japanese *Advertiser,* 9 Oct.—The air corps of the Imperial Army is an object of criticism because of its unsuccessful sham bombing fight. The war authorities issued a statement that the censure is mistaken, but it is clear that the contention is suspected of having been fabricated. It says that bombing operations by the navy's airplanes at Kasumigaura were utterly unsuccessful, but this is evidently false, because seaplanes did not hold bombing maneuvers at that time. The war authorities are attacked for their false charge.

The percentage of hits by the navy's airplanes was eighty-eight, while that of the army's planes was zero. The war authorities prepared the plan for the bombing maneuvers, whereas the number of bombing machines which participated in it were only two. It was unfortunate that these planes met with accidents on their way home. The army's airplanes are mostly of old types, while the training of pilots is neglected. The navy's air corps at Kasumigaura has ten machines flying every day, but that of the army has only a few which fly. Whenever a stiff breeze blows, the army's air corps refrains from flying, they are not well trained in the flight of formation, they seldom hold night flights, and when they undertake a long flight they are always unsuccessful. The headquarters of the air corps and the school and office buildings alone are glorious. It is for these reasons that we call such a system of defense a bureaucratic military preparation.

The air forces of Great Britain are no exception. They neglect to strengthen their fighting efficiency, although they direct their efforts to the construction of offices, schools, barracks, and other necessary provisions. The estimates for the current fiscal year are put at £16,000,000, of which £5,350,000 is appropriated for the purchase of machines. The London *Daily Mail* one day had a picture of the air corps, ridiculing English air soldiers as being like infantry on review and condemning the English air forces as good for nothing. This is cutting sarcasm, but the

English air forces are not so bad as those of the Japanese Army, because Great Britain has a formidable rival in France beyond the channel. The principle of the English air forces is to obtain sufficient personnel in time of war and train the men in conformity with it, while in the meantime they are carefully considering how to promote industrial efficiency in order to provide against contingencies.

In the recent bombing maneuvers, the air corps of the Imperial Navy demonstrated its efficiency. The success enhanced its credit and prestige. The weak points of the army air forces are the strong points of the navy air corps. It can be deduced from this that the navy fliers are faithful to their duties, but it does not show that the air policy of the navy authorities is effective. We say this because the Imperial Navy has no definite principle for its air administration. Its administrative organ is not systematic, the force of air machines being slighted. The navy authorities press the government to complete the construction of auxiliary ships within five years in accordance with the plan, but these ships have no provision for carrying planes, whereas all the capital ships and light cruisers of the United States have flying machines on board. The United States Navy has two airplane carriers in active service, but the Imperial Navy postponed finishing one of its airplane carriers until 1928. The efficiency of bombing machines must not be ignored. A small destroyer was exposed to fire from many large caliber guns for two days. It was hit by none, but was sent to the bottom by a bomb from mid-air. The nation must have a well balanced navy, but the Imperial Navy is far from being such. This is a great danger to national safety. It is doubted whether the war and navy authorities use their expenditures wisely for national defense.

Military Training

Japanese *Advertiser,* 7 Oct.—Only three months have passed since the enforcement of military training for young men, yet it is said that its future is not promising. In the beginning the attendance was fair, owing to the effect of propaganda, but the number has diminished nearly by half. In some localities, the training has but a few in attendance. It is lamentable that our presupposition proved true, and the realization of this surprising state of affairs by the authorities concerned is disappointing. The government grants 1,000,000 yen while prefectural governments spend 10,000,000 yen for this purpose, so means for encouragement must be considered.

The causes are varied, but the most important ones are that the privilege of a limited term of service does not extend to arms other than the infantry, that young men who are weeded out as unfit for military training do not attend the training, that the officers in charge have but slight ideas about citizenship, while they

are governed too much by the military spirit, that lectures do not provoke any ardor in young minds, and also that young men suffer from undue burdens.

The education and war authorities stressed the necessity of instructing young men in citizenship, but it is evident from the allotment of hours that the principal purpose is the limitation of the term of military service. This is why those who are weeded out as unfit for the duty by medical examination and who will be enlisted in arms other than the infantry do not feel disposed to attend lessons.

It is said that the system of military education has attained remarkable progress, but it stands on the basis of power and authority, while the principle of modern education looks for unified activities consequent upon the growing self-consciousness within individuals in regard to the position they hold as members of the nation and society. This idea has a strong hold upon young minds. The principle of power and authority upon which military education is systematized conflicts with the developing reasoning faculties and susceptibilities in young men.

Lectures do not provoke any ardor because the subjects are diversified despite limited hours, from which their worth can be easily imagined. It is natural that young men, however patient and enduring they may be, can not bear the futile cramming of worthless crude knowledge. It must be painful for them.

The system is defective, as we point out. Its rectification must be effected at an early date. The military training for young men is systematized upon a mistaken principle. Undue importance is attached to war-like preparations as a factor of national defense. The idea that national propensities can be remoulded by stringent drill or military manual exercise is a mistake. Too many lessons have been adopted in order to please the general public, but this is also an error, while the military training in question is independent of supplementary schools and young men's associations. The limitation of the term of military service for economizing military expenditures is considered to be conducive to the curtailment of national expenditures, but this is also a mistake.

These mistakes must first of all be set right for the improvement of the military training system under discussion. It is important for young men to have sound ideas about the fundamental principles of the nation, to be efficiently instructed in the elementary principles of modern science, to promote physical energy and strength, to be imbued with the spirit necessary for organized activities, and to be taught a profession for practical life. These qualifications will enable the nation to maintain its life, to increase the national wealth and to make young men excellent fighters within a limited term of military service.

Our ideal in regard to military training is to create such young men, for which purpose a fundamental improvement must be effected in the present system.

Naval Notes

Le Yacht, 16 Oct.—[Translated by Assistant Professor Henry Bluestone, U. S. Naval Academy].—The Japanese Admiralty has decided to place scouting and pursuit planes on various categories of battleships and cruisers. An appropriation of three million yen for that purpose is provided for in the next naval budget. The battleships and battle cruisers will receive each three planes, the light cruisers *Furutuka* and *Kato,* of 7,100 tons, which have just finished their trials, and the *Aoba,* similar to them, which has just been launched, on September 24 at Yokohama, will have only two planes; finally, fourteen cruisers of the *Kuma* class (5,500 tons, 1919-1925) and the older cruisers will have only one plane each. This measure fixes definitely the adoption of the airship as a naval arm. The program will further be completed by the embarking, on ships of the above mentioned types, of a commander and a lieutenant commander as heads of the air services.

In a general manner, Japan is working actively for the development of its aviation. An airdrome is to be established at Kogori. A dirigible, the *No. 3* is being constructed in Italy. It is eighty-five meters long; fifteen meters in diameter; 7,000 cubic meters in volume. It can raise a usable load of 2,500 kilograms, and runs at the rate of 100 kilometers an hour, with its two motors of a total power of 500 Cv.

The hydroplanes of the centers of Omura and Sasebo have made this summer a flight toward Formosa, where the airship carrier *Wakamiwa* of 5,875 tons was sent.

The torpedo boat *No. 32* of 1,445 tons was launched in the navy yard of Sasebo last July.

In a previous number we have given some details on the Japanese replacement naval program, the execution of which extends over the fiscal years of 1926 to 1931.

A second program is now being elaborated to replace the light units which will be obsolete after 1931 and which are:

Fiscal year of 1931-32: one torpedo boat of 1,300 tons; three submarines of 850 tons; six submarines of second class.

Fiscal year of 1932-33: six torpedo boats of 1,345 tons; seven torpedo boats of 850 tons; six submarines second class.

In addition, it will be necessary to replace, commencing with the fiscal year 1931-32 the capital ships authorized by the agreements of Washington.

For economic reasons, the construction of the repair ship provided to replace the *Kanto* of 6,193 tons, which sank, was post-

poned to the fiscal year 1928-29. Its place will be taken, provisionally, until 1930-31, by the *Ashi*, a salvage ship for submarines. The *Ashi* is at present being altered and will be ready toward the end of the current month. Its twelve boilers will be replaced by four others of a new type, and it will have a speed of 12 knots.

The draft of the budget for 1927 includes appropriations necessary for the reinforcement of the frontier garrisons. The reinforcements provided for are said to be six companies (1,100 men) for the frontier of Corea; 1,000 men for the troops detached in Manchuria, two companies for North China. All strategic points of the Corea frontier will be furnished with wireless service. On the other hand, the attention of the Japanese maritime authorities has been called to events of South China and Central China, and reinforcements of war ships are being sent to various points of the Chinese coast and Chinese rivers.

New York *Times* 4 Oct.—The disagreement between the Japanese Admiralty and the treasury over the naval program continues. The Admiralty is willing to modify its original demand of four cruisers, sixteen destroyers, five submarines, three river craft, and five special service craft, to cost 294,000,000 yen, spread over four years.

It now proposes reducing the number of special service craft, and possibly of new destroyers, but declines to lower the number or tonnage of cruisers and submarines.

It is believed, however, that the Admiralty will agree to some extension of the period of construction. These suggested concessions represent 20,000,000 yen saved, but the treasury asks for still more economy.

Baltimore *Sun*, 5 Oct.—The Westminster *Gazette* today says that the Japanese Admiralty has bought a fleet of the latest type British Blackburn-Napier torpedo airplanes.

The planes can be used for land work or as seaplanes. They are designed to dive toward an enemy ship at 150 miles an hour, discharging torpedoes when a few feet above the water and then zooming upward almost vertically out of the range of machine guns.

London *Times*, 8 Oct.—The vernacular newspapers devote much space to the discussion of an alleged intention of the Navy Department to make a proposal, possibly at the Disarmament Conference, for the limitation of the appropriation for naval upkeep in the annual Budgets of the nations to the sums necessary for defensive purposes. The Navy Department admits that the pro-

posal is under consideration, but will neither confirm nor deny that it has the intention to submit it to the Disarmament Conference.

It is generally believed that the proposal is the outcome of the perennial conflict between the Treasury and the Admiralty, and that it is doubtful, in any case, if the scheme would work internationally.

ITALY

Italy Reported Preparing for Attack

New York *Times,* 10 Oct.—The *Daily Express* today intimates that Italy is preparing for war against Turkey. The article declares that Benito Mussolini, Premier of Italy, is planning, with the cooperation of Greece, to secure for Italy a zone of influence around Adalia, Asia Minor, which was promised Italy in 1915 by a secret pact in London between Russia, France, Great Britain and Italy, and which the Bolsheviki disclosed in 1917.

Turkey, says the newspaper, is aware of the plan and maintains four army corps, permanently mobilized. Signor Mussolini believes the methods he has devised cannot possibly fail if put into operation. Greece would attack Turkey through Thrace, while the Italians attacked in the south. Greece's reward would be the repossession of the Smyrna territory. Rumania's neutrality was secured by a promise of support regarding Bessarabia.

Great international efforts are being made, the *Daily Express* declares, to persuade Signor Mussolini to desist, and it is urged in some quarters that the United States should be invited to exert its influence for peace. While France is believed to be not entirely averse to the Italian aims if they can be attained without war, the newspaper asserts that Great Britain is on the side of peace and its efforts, in conjunction with possible aid from America, may limit Signor Mussolini's plans to an unfilled threat.

Italy's Naval Progress

Naval and Military Record, Oct.—Italian naval progress is being watched here with great and legitimate interest. The strenuous bid of the peninsula for Mediterranean supremacy has, of course, more chance to be directed against France than against any other power. Mussolinian papers are in the habit of not mincing words on that ticklish subject. Efficiency never was greater in the peninsular navy than at the present moment. Nothing sensational is done on paper, no *minfigues programmes* to be accomplished tomorrow, but everywhere instant act on, the spirit of *offensive à outrance* and of fervent patriotism, while the well-directed Roman Admiralty pays the utmost attention to every item of fighting importance, and is ever experimenting with new weapons and new devices. Fighting spirit is much in evidence. Cargo boat and Liner designs are being submitted to the Admiralty with a view to their eventual utilization in war time. Lectures

on the past and the future and the greatness of Italy on the water are being made wholesale, while recruiting cruises are being carried out along the coasts. Strategic maneuvers on a large scale are for the third time within the last few years being conducted under Admiral Mola around Sardinia Island, the importance of which in the Mediterranean naval game is obvious.

Mine Layer Legnano

Revista Generalde Marina, Aug. [Translated by Assistant Professor Henry Bluestone, U. S. Naval Academy.]—In the issue of April last, we gave an account of the launching of the first mine laying gun boat of a series of ten that are planned. The second of these, called the *Legnano,* was launched at Ancona in May. Its specifications are as follows: displacement, 700 tons; length, 60 meters; power of engine, 1,500 h. p.; velocity, 15 miles per hour; armament, two guns of 10 centimeters. It will be seen that the new mine laying boat is superior to the *Durazzo.* The latter, it will be recalled, has a displacement of about 600 tons and its speed is only 10 miles per hour. It appears that both are to carry 200 mines; however, the *Durazzo* has only one cannon of 75 centimeters.

ARGENTINE

Naval Program

Revista General de Marina, Aug. 1926. [Translated by Assistant Professor Henry Bluestone, U. S. Naval Academy.]—The government of this republic has appropriated the amount of thirty-two million pesos for the construction of new naval units. The program has not as yet been concretely fixed, although it is believed that it will consist of two cruisers, three destroyers, two submarines, and two gun boats. The new ships will be constructed in Europe, and for the information of the government on this point, a committee has been appointed under the chairmanship of Admiral Galíndez. This committee has visited the principal European shipyards, among them those which the Sociedad Española de Construcción Naval has in our navy yards. The decision of the Argentine government is awaited with great expectation.

With the completion of these ships, the Argentine Navy will acquire a superiority over the other South American naval powers, Brazil and Chile, as the naval power of these three countries is at present on about the same footing. That of the Argentine Republic consists of two battleships, built in 1914, of 28,000 tons, with twelve guns of 30.5 centimeters, which ships, as previously stated have been modified recently and accordingly are considered as being of great military value; four armored cruisers of the Italian type *Garibaldi,* which though of an antiquated type have their value compared with those of other small South American

powers; one armored coastguard, four destroyers built in Germany in 1911 and three in England in 1896. Attention is called to the fact that the Argentine Navy does not have any submarines. However, the present minister of the navy realizes the necessity of the services rendered by such boats, includes in his program the construction of two of them.

ENGINEERING

Turbo Ventilators for Firing

La Revue Maritime, Sept. 1926. [Translated by Assistant Professor Henry Bluestone, U. S. Naval Academy.]—The units of the naval program for 1922, the execution of which is now under way, are profoundly differentiated from the older units both by their internal organization and by the use, on board, of apparatus that are entirely new.

Particularly the necessity to obtain a high propulsive power while remaining within the very narrow and restricted tonnage limits stipulated by the recent Washington agreements has led the technical services of the navy to generalize, aboard the ships, the use of turbo-motors which alone are capable of furnishing a high power while maintaining advantages of weight and dimensions which constitute, in this particular case, a factor of highly appreciable importance.

In addition, these motors offer, from the point of view of maintenance and running, a simplicity unequalled by any of the thermic motors of other types. In fact, the small number of parts in motion, the absence of closely adjusted devices, the automatic operation of the oiling and regulation devices, the possibility to utilize, without purifying, the exhaust steam of the turbines, which never presents any trace of oil, render possible the performance of all the services with a minimum of accessory apparatus and, therefore, the reduction, in a great proportion, of the personnel required for supervision and care.

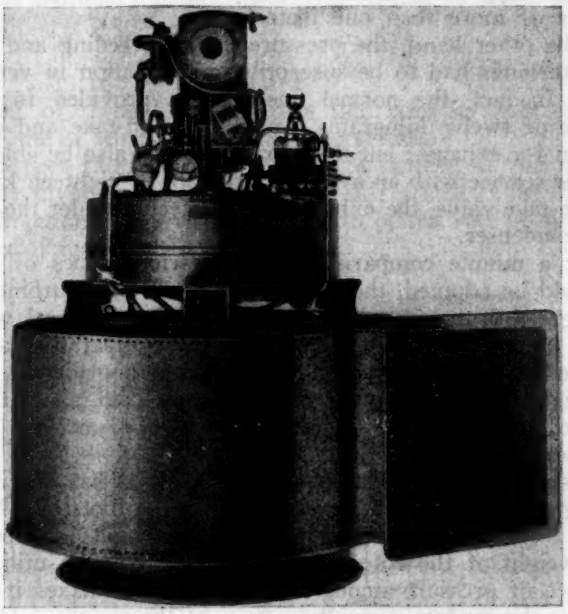
It is in view of these advantages that the alternating motors have been replaced by steam turbines on the latest units for the operation of all the auxiliary organs on board.

Similarly, in order to bring the distribution of air in the combustion chambers of the boilers in harmony with the intensive production of steam, the use of ventilators of broad specifications had to be considered. As these apparatus must further be adaptable to all degrees of vaporization rendered necessary by differences in speed of the ship, their advantages in power had to be coupled with great ease of operation.

Probably in the elaboration of the last program, the Indret firm, with the view to find the most favorable arrangement, performed, on various types of boilers, very elaborate tests for which the Rateau Company had furnished a ventilator intended to furnish the air necessary for the burning of mazout (form of oil).

As soon as the ensemble of the program for 1922 had been fixed, the Rateau Company was called upon to study more specially the turbo-ventilators intended to feed mazout burners.

These considerations of space and weight, which in this particular case were given the highest importance for the reason that the ships had to offer considerable technical and military advantages while remaining within the imperative limits of tonnage, led to the elimination of machines with horizontal axles placed on the floors of the engine rooms,—as being too heavy and



FIRING TURBO-VENTILATOR OF THE RATEAU CO.

occupying too much space,—and to consider the construction of apparatus with vertical axles placed immediately under the main deck. This arrangement offers the advantage of clearing the ways of the furnace (?) and leaving them free for the care and supervision of the parts of the boiler.

The firing turbo-ventilators consist of a ventilator with a spiral at the top, and below of a turbine for the operation of the ventilator, carrying all the necessary accessories for the starting, regulating, and oiling of the apparatus.

The special characteristics of the Rateau ventilators enable them to operate in parallel on the same circuit, each apparatus maintaining automatically a rigorous equality of pressure and furnishing the output compatible with that pressure. However, in order

to avoid any false move, each of the ventilators has been provided with an automatic flap valve, thus preventing the return of air into an apparatus as a result of unforeseen stopping, and allowing the other apparatus on the same circuit to continue operating normally.

For the construction of these groups, the special conditions of operation aboard a ship and the necessity to save space so far as possible imposed the adoption of relatively high rotation speed. In order to maintain for these apparatus all necessary security of operation, special precautions have been taken in the construction of the moving parts of the ventilator; some of them have a diameter of more than one meter.

On the other hand, the pressure in both feeding and exhaust of the turbines had to be susceptible of variation in very broad limits. In fact, the normal operation is provided for with a pressure of twelve kilograms available for in-take and one half kilogram for exhaust; but the apparatus must also be able to perform the service with an available pressure of eighteen kilograms at the in-take valve, the exhaust being effected under the vacuum of the condenser.

After a minute comparison of the various types of turbines that could be adopted, the choice was fixed on a turbine having two degrees of pressure, each degree having a wheel with two degrees of speed. The tests made on these apparatus have fully confirmed the results expected from that arrangement.

Air-tight devices make it possible to pass from one to the other means of exhaust while avoiding the entry of any air into the condenser.

The special arrangement of these apparatus has for its effect to bring the entire weight of the rotor on the footstep (?) thrust bearing. Although the weight bearer was built to support the entire weight of the rotor, the balance effected by utilizing the difference of pressure among the various parts makes it possible to reduce the push to a small fraction of the weight. The oiling of the weight bearer is provided for by means of an oil pump operated by the regulating shaft. The regulation is secured by means of a centrifugal regulator acting directly on the steam valve.

The tests made on these apparatus, under conditions to be provided for, have fully confirmed all anticipations, and particularly under slower operation they have revealed a consumption of steam that is less than provided for. The special arrangements adopted have, further, made it possible to check up the satisfactory operation of two apparatus in parallel.

The Rudder and its Relation to the Ship

The Shipbuilder, Oct. 1926.—Elementary knowledge concerning the reaction between a rudder and the surrounding water is generally based upon the experiment study of planes moving obliquely through a fluid.

From the results of experiments he made with square planes, towed through water, Colonel Beaufoy evolved the formula $P=1 \cdot 12\ A\ V^2 \sin \alpha°$ (for salt water), P being the normal pressure on the plane, A the area, V the velocity and $\alpha°$ the angle of inclination of the plane to the direction of motion; the units are in lb-feet-seconds. This has become the favorite formula in this country for estimating the pressure on a rudder.

On the continent and in the U. S. A. Joessel's formula is perhaps more popular. This formula was derived from experiments on stationary planes fixed in a stream of water and is as follows:

$$P=A\ V^2 \times \frac{\cdot 787 \sin \alpha}{\cdot 195 + \cdot 305 \sin \alpha}$$ units: lb-feet-seconds.

Neither of these formulæ takes into consideration the shape of the plane or what is called its "aspect ratio."

The aspect ratio of a plane may be defined as the ratio obtained by dividing the length of the side which is perpendicular to the direction of motion by the length of the side oblique to the direction of motion.

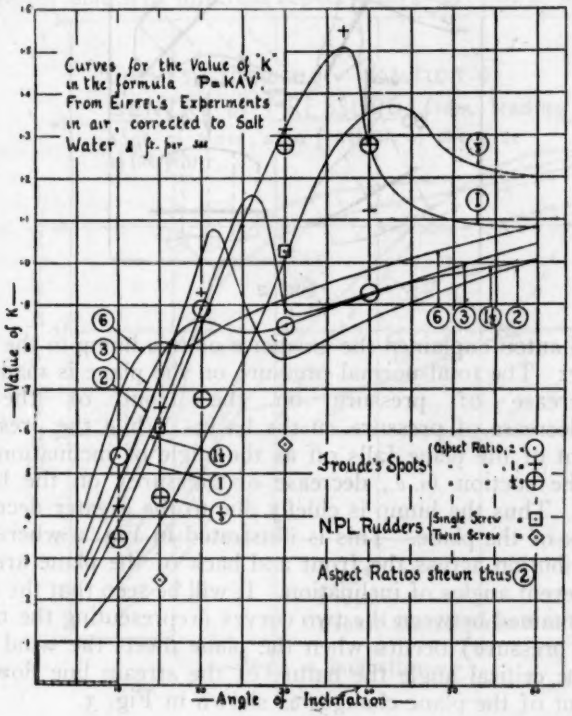

Curves for the Value of "K" in the formula P=KAV². From Eiffel's Experiments in air, corrected to Salt Water & ft. per sec
—Value of K—
—Angle of Inclination—
Froude's Spots
Aspect Ratio, 2
1
½
NPL Rudders
Single Screw
Twin Screw
Aspect Ratios shewn thus (2)

FIG. 1

Fig. 1 shows curves constructed from the results of Eiffel's experiments in air with planes of different aspect ratios. The ordinates of these curves give the value of K when the pressure on the plane is expressed as $K.A.V.^2$; the values shown on the scale have been corrected to apply to salt water. A few spots are also shown taken from Mr. R. E. Froude's experiments in water.

It will be observed that up to about 12° inclination the values of K vary with the aspect ratio, but at greater angles their behavior is irregular. It is characteristic of all these curves, as will be seen from Fig. 1, that they come to a "hump" at some angle proper to the aspect ratio of the planes they represent; the angle at which the hump occurs is called the "critical angle" for that particular plane.

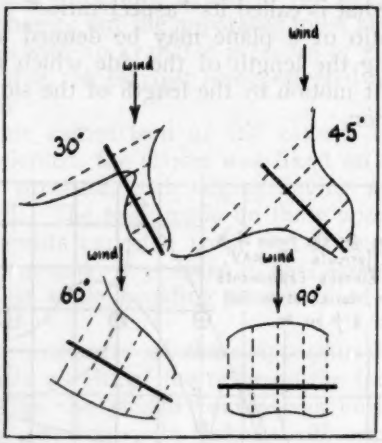


Fig. 2

Dr. Stanton explained the existence of this hump in the following way: The total normal pressure on the plane is made up of an increase of pressure on the front of the plane and a decrease of pressure on the back. While the pressure on the front of the plane falls off as the angle of inclination diminishes, the suction (*i. e.*, decrease of pressure) on the back increases. Thus the hump is chiefly due to the greater decrease on the back of the plane. This is illustrated in Fig. 2 where curves of distribution across the front and back of the plane are shown for different angles of inclination. It will be seen that the greatest area contained between the two curves (representing the resultant normal pressure) occurs when the plane meets the wind at 45°.

At the critical angle the nature of the stream line flow across the front of the plane changes as shown in Fig. 3.

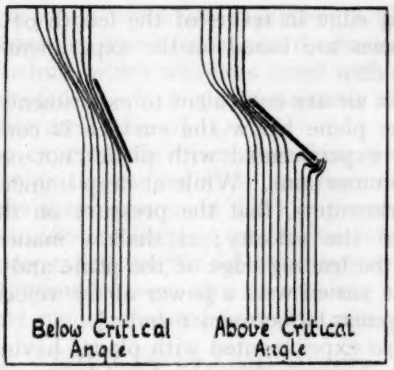


FIG. 3

The aspect ratio of the plane also affects the position of the "center of pressure," or the point at which one resultant force might be substituted for the whole distributed normal pressure on the plane, this point being dependent on the angle of inclination. The curves in Fig. 4 show the position of the center of pressure for planes of different aspect ratio expressed as a distance

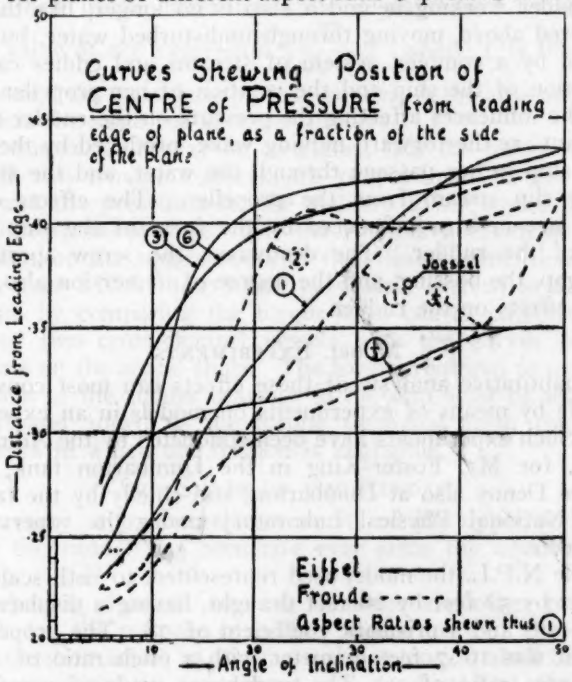


FIG. 4

from the leading edge in terms of the length of the side of the plane; these curves are based on the experiments of Eiffel and Froude.

Experiments in air are equivalent to experiments in water when the depth of the plane below the surface is considerable. Mr. Maurice Denny experimented with planes not only at deep but also at shallow immersions. While at deep immersions he found, like other experimenters, that the pressure on the plane varied as the square of the velocity; at shallow immersions, between depths equal to the leading edge of the plane and zero, the resistance of the plane varied with a power of the velocity considerably less than 2 and generally between 1 and $1\frac{3}{4}$.

Mr. Denny also experimented with planes having curved faces, representing the shape of a double-plated balanced rudder having the thickest part one-third of the length from the leading edge. The results he obtained with these planes agreed with those for the flat planes as far as speed index was concerned; but the transverse forces, and to a less extent the fore and aft forces, were found to be less than those developed by the flat planes.

Rudders

A rudder working behind a ship is no longer, like the planes considered above, moving through undisturbed water, but is surrounded by a complex system of streams and eddies caused by the motion of the ship and the rotation of her propeller.

Of the influences affecting the pressure on the rudder the most important are the forward moving wake, produced by the friction of the ship in her passage through the water, and the sternward moving slip stream from the propeller. The effects of these factors are in turn influenced by the form of the ship and the shape of the rudder. The deadwood, the screw aperture, the pintle gap, the bossing, and the degree of immersion also produce special effects on the rudder.

Model Experiments

A quantitative analysis of these effects can most conveniently be made by means of experiments on models in an experimental tank. Such experiments have been conducted by the Admiralty at Haslar, for Mr. Foster-King in the Dumbarton tank, by Mr. Maurice Denny also at Dumbarton, and chiefly by the tank staff at the National Physical Laboratory under the supervision of Mr. Baker.

At the N.P.L. the model used represented, to $\frac{1}{25}$th scale, a ship 400 feet by 52 feet by 26 feet draught, having a displacement of 10,400 tons and a prismatic coefficient of .78. The propeller represented was 16 .7 feet diameter with a pitch ratio of 1 .2 and a disc area ratio of .4. The model was made of paraffin wax, fitted with a metal stern frame, propeller and rudder.

After a single-screw series of experiments had been carried out, the screw aperture was filled in and the normal form of bossings added to the hull, which was then fitted with model propellers representing twin screws of 12 ·5 feet diameter with a pitch ratio of 1 ·5 and a disc area ratio of ·4.

In any single experiments three quantities were measured:—(1) the pressure on the rudder (P), (2) the torque on its stock (T), and (3) the turning moment (M) impressed on the model, which was constrained to keep on a straight course. This turning moment Baker called the "initial ship turning moment."

"Yawing" experiments were also carried out to determine the rate at which the model deviated from the straight course.

The Law of Comparison

In connection with model experiments the important question arises as to what relation exists between the forces and moments acting on the model and those on the full size ship.

In order to investigate this question Baker measured the forces and torques on three similar rudders whose linear dimensions were in the proportion of 1 : 2 : 3. These three rudders were run at "corresponding speeds," *i. e.*, at speeds proportional to the square roots of their linear dimensions, and it was found by so doing that the value of the expression $\frac{T}{l\ A\ V^2}$ (where T is the torque of the stock, l the mean length of the rudder, A the area and V the speed) was the same for all three rudders.

From this result it may be concluded that the torques on the stocks of two similar rudders are proportional to the fourth powers and the pressures on the rudders to the cubes of their linear dimensions, provided that the rudders are run at speeds proportional to the square roots of their linear dimensions.

Denny (see I.N.A., 1921) had previously arrived at the same conclusion by comparing the torque-helm curves obtained from models of two cross-channel vessels with the curves obtained from trials on the actual ships. The torque required to overcome the friction of the rudder bearings in the ship must be separately estimated and added to the torque predicted from the model experiments in which the friction is negligible.

The Shape of the Rudder

Controversy as to the relative merits of the upper and lower parts of the rudder has been rife ever since the advent of the steamship.

Ships having deficient steering qualities are often placed in dry dock for the purpose of adding to the area of the rudder, and the question arises as to where the extension shall be made.

Many years ago an experiment was conducted at Haslar on a model of the *Encounter*. The rudder of this model was divided

horizontally so that the upper and lower parts were of equal area and were fixed on the stock with an angle of 30° between them. The model was then towed by the bow, and it was found that when the upper half of the rudder was 20° to one side and the lower 10° to the other the model towed on a straight course, thus indicating the greater efficiency of the lower part of the rudder.

In 1904 Mr. Foster-King's experiments at Dumbarton appeared to prove the opposite. Two triangular rudders were tried, one with its apex at the water-line and the other having its apex at the heel. It was found that, except behind very fine models, the rudder which was broad at the water-line gave more ship-turning moment than the one broad at the heel. In the finest model tried,

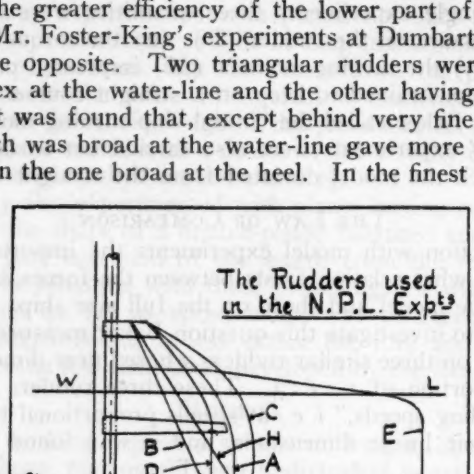


Fig. 5

however, the reverse was the case. It is therefore possible that the two experiments were not actually contradictory, as the model of the *Encounter* may have been as fine as the finest model tried at Dumbarton.

Mr. Foster-King also showed by his experiments that a rectangular rudder of the same height and area as a corresponding rudder of the ordinary merchant-service pattern would produce the same ship-turning moment as the latter with less torque on the stock.

In the foregoing experiments, however, no screw was used, and therefore the results obtained cannot be applied to screw steamers.

The effect of varying the shape of the rudder was more thoroughly investigated at the N.P.L., where the rudders shown in Fig. 5 were tried under full working conditions, both behind single and twin-screw models. Full results of these experiments are given in papers by Baker and Bottomley before the Institution of Engineers and Shipbuilders in Scotland.

In general, the results obtained showed that, in the case of the single-screw model, the shape of the rudder might be varied, keeping the area constant, between the limits of *B* and *C* (Fig. 5) without materially affecting the ship-turning moment developed. Rudders *E* and *H* were not tried behind the single-screw model.

Rudder *D*, the normal type of merchant-service rudder, gave the greatest ship-turning moment per unit of torque on the stock, and on this account is perhaps to be preferred. Type *B*, however, is advantageous in the light condition, as might be expected.

Rudder *A* was introduced to ascertain the effect of increasing the area of the rudder; it was found that increase in area increased the ship-turning moment, but to a less extent than would be proportional to the area increase.

The torque of the stock is proportional to the area and mean length of the rudder; hence for a given area a short deep rudder is preferable to a long shallow one.

The efficiency of the rudder behind the twin-screw model was found to depend very much upon the angle at which the after edge of the rudder entered the screw race, and therefore upon the shape of the rudder. In the twin-screw series rudder *H* was added to those tried behind the single-screw model and produced quite the best ship-turning moment throughout the series, its superiority being most marked at 30° helm, at which angle it developed 17 per cent more ship-turning moment than rudder *D*. This result was due to the peculiar shape of *H* enabling it to take greater advantage of the screw race; for the same reason *A*, being longer than *D*, showed a superiority over *D* at 30° helm which it lacked at 15°, at which angle it had not yet reached the race. Rudder *C* developed more ship-turning moment than *B* at 15° helm, but less at 30°, for much the same reason.

Wake Effect

The wake created by the motion of the ship through the water reduces the normal pressure on the rudder for three reasons, *viz.*: (1) the velocity of the water past the rudder is reduced owing to the frictional wake or belt of eddying water dragged along by the ship; (2) eddies are formed in the neighborhood of the rudder owing to the instability of flow of the diverging streams at that part; and (3) the streams close in round the stern in a diagonal direction, upward and inward, the upward component again reducing the speed of the water past the rudder. Generally speak-

ing, the fuller the lines of the ship the greater will be the reduction of pressure due to these causes.

This frictional wake affects more particularly the fore part of the rudder as it is that part which lies within the belt of eddying water; it will therefore tend to move the center of pressure away from the stock. Moreover, the upper part of the rudder is likely, owing to the greater fulness of the ship at that part, to be more affected than the lower; hence the center of pressure may lie somewhat below the center of gravity of the rudder.

Dr. Stanton (I.N.A., 1909), experimenting with planes behind wedge-shaped bodies, discovered that when the divergence of the streams was five degrees with respect to the sides of the tank (*i.e.*, with the plane behind a 10-degree wedge) the normal pressure on the plane was roughly half as great as when the plane was in streams flowing parallel to the sides of the tank. Divergence of the stream lines in the wake may therefore be expected to reduce the pressure on the rudder.

Baker isolated the total effect of wake by comparing the pressures and torques on the rudder behind the model with the pressures and torques on the same rudder run behind a fin plate. For the single-screw comparison an aperture, similar to the propeller aperture in the model, was cut in the fin, while in the twin-screw series this aperture was filled in and the fin was fitted with web plates representing the general plane of the model's bossings.

The shape of the rudder was found to have some effect, though slight, on the reduction of pressure due to wake, because the longer rudders had a greater part of their area clear of the eddy belt. Thus, rudders *A* and *B*, in the single-screw series, showed less reduction than *D*. In all cases the reductions were greater at 8 knots than at 12 knots, which indicates that the forward speed of the frictional wake is greater, compared with the speed of the ship, at the lower than at the higher speed.

The mean reduction of pressure on the rudder tested behind the single-screw model was 59 per cent at 8 knots, and 54 per cent at 12 knots, with 30° of helm, and slightly more at 15°, *viz.*, 66 per cent and 61 per cent at 8 and 12 knots, respectively.

The corresponding figures for the twin-screw model were 46 per cent and 39 per cent at 8 and 12 knots, respectively, with 30° of helm, and at 15° helm, 59 per cent and 55 per cent for 8 and 12 knots, respectively.

It will be seen that the reduction of pressure is slightly less for the twin-screw than for the single-screw model; the probable explanation of this result lies in the modifying influence which the twin-screw bossings may exert on the diagonal movement of the streams.

The reductions in torque were generally somewhat less than in pressure, especially in the single-screw series, thus indicating a movement of the center of pressure away from the stock.

The Race Effect

The effect of the screw race is to increase the pressure on the rudder owing to the sternward velocity of the slip stream. The relative velocity of water past a rudder, working behind a screw, is the speed of the ship plus the slip of the screw, and since the real slip of the screw is increased by wake of the ship the increase of pressure on the rudder due to race may be expected to be greater behind the screw of a ship than behind the same screw in open water. This was shown to be the case by the experiments at the N.P.L., in which the pressure on the rudder, both with and without screw, was measured both behind the model and behind a fin plate.

In the single-screw series rudders *A, B, C,* and *D* gave very similar results, showing about 150 per cent increase in pressure due to the screw-race behind the model, and about 50 per cent increase due to the screw-race when the screw revolved in an aperture in the fin plate.

The torques were in most cases increased less than the pressures, indicating a movement of the C.P. towards the stock.

The ship-turning moments were increased much less than the pressures and torques, *viz.,* about 87 per cent, which result Baker ascribed to the interaction between the rudder and the screw, which causes the screw to deliver greater thrust on the side to which the rudder is put over.

As would be expected, the N.P.L. experiments showed the race effect to be much smaller in the twin-screw model, since the rudder has to swing to a considerable angle before it enters the screw race.

For the same reason there was considerable difference in the effect produced on rudder *D* and rudder *H,* and the results for 30° helm were widely different from those for 15°.

The torques in the twin-screw series were increased far more than the pressures, because it is the after part of the rudder which first feels the race effect. The ship-turning moments, unlike those in the single-screw experiments were increased about as much as the pressures. The difference in the race effect due to wake was far less marked than in the single-screw series, probably due to the twin screws working in a zone largely clear of the frictional wake.

At 30° helm rudder *H* showed an increase in pressure, torque and ship-turning moment of 15 per cent, 23 per cent, and 16 per cent, respectively, while for *D* the corresponding figures were 4 per cent, 5 per cent, and 5 per cent, respectively. At 15° helm the increases were negligible.

The effect of substituting inward for outward turning screws was found to be a further increase in pressures, torques and ship-turning moments due to race.

Increasing the diameter and pitch ratio of the screws also tended to increase the race effect, but changing the fore and aft position of the screws produced no alteration in the race effect, within the ordinary limits of position.

The Total Effect of Race and Wake

The total effect is the difference between the pressure and torque on a rudder behind a ship with the screw working and the pressure and torque on the same rudder behind a fin plate with no screw, the fin being provided with an aperture or with bossing webs for single or twin-screw comparisons, as before described.

Table I has been deduced from the results of the experiments conducted on these lines at the N.P.L.

Table I

Showing per cent Increase (+) or Decrease (—) of Pressure and Torque on Rudder due to the combined Effect of Water and Race

Helm.	Rudder.	8 knots.		12 knots.	
		Pressure.	Torque.	Pressure.	Torque.
Single-screw.					
30°	Mean of *A, B & D*	3	9	12	17
15°		−10	−5	− 4	− 2
Twin-screw.					
30°	*H*	−30	−19	−23	−16
	D	−46	−41	−40	−35
15°	*H*	−56	−51	−53	−50
	D	−64	−62	−61	−60

It will be seen from this table that in the single-screw model the race was found to outweigh the wake with 30° helm, but at 15° the wake predominated. In the twin-screw experiments the wake was found, even at 30° helm, to be much stronger than the race. In both cases the center of pressure appears to have moved out from the stock.

The Effect of Deadwood

The streams flowing along the inner side of the deadwood are retarded, and those on the outer side accelerated, when they are forced to change their direction at the rudder stock, the result being a resultant extra outward thrust, not only on the rudder, but also on the deadwood itself.

Unfortunately, the extra thrust on the rudder, due to the banking effect of the deadwood, has not been separated from the thrust induced on the deadwood. Some experiments conducted in air channels at the N.P.L. by Messrs. Cowley, Simmons and Coales have shown that up to about 15° of helm there is no material

difference in the pressure developed due to the presence of deadwood (or a fin, in this case); at 25° the total increase on the rudder plus fin amounted to some 40 per cent; while at 40° the total increase was about 150 per cent.

Baker ran his rudder *E* (Fig. 5) with and without a fin at 8 and 12 knots, and it is curious that in both cases the presence of the fin seems to have reduced the pressure on the rudder.

The difficulty of calculating the pressure on an unbalanced rudder behind deadwood from the corresponding pressure on a plane in open water arises from the fact that, whereas the pressure-helm curve of the latter exhibits the typical hump mentioned, the curve for the former shows no such irregularity, but follows more nearly the shape of a sine curve.

The screw aperture and the pintle gap naturally tend to modify the deadwood effect. Experiments were carried out at the N.P.L. on a rudder behind the single-screw model, first with the screw idle, and then with the screw removed and the aperture filled in. It was found, with 30° of helm, that the pressure, torque, and ship-turning moment were increased by filling in the aperture 26 per cent, 21 per cent and 56 per cent, respectively. The value of the pressure developed on the deadwood itself is clearly demonstrated by the disproportionate increase in the ship-turning moment. In practice, however, this apparent advantage is outweighed by the reduction of the moment of resistance which can be effected by the removal of the deadwood.

The center of pressure, it will be observed, was brought nearer to the stock, a result that might be expected since it is the fore part of the rudder which is most affected by the deadwood.

Filling in the pintle gap was also found to increase the forces and moments developed, and it is thought that the loss in rudder efficiency due to this gap may be of importance in twin-screw vessels in which there is no screw aperture.

The Effect of Bossings

The experiments on this subject are very incomplete. Mr. Foster-King, in the experiments referred to earlier, found that, in the moderately full model on which the effect was tried, the presence of bossings increased the efficiency (presumably the ship-turning moment) of a rectangular rudder some 15 per cent. Further experiments with the two triangular rudders indicated that the bossings increased the pressure on the upper and reduced the pressure on the lower part of the rudder.

Immersion and Surface Effects

Havelock has shown that there is a critical relation between immersion and speed for the production of maximum wave-making resistance by a submerged object.

In the case of a rudder the greater the surface disturbance produced by it the greater will be the pressure developed; the normal

pressure on the rudder will therefore reach a maximum at some critical speed, corresponding to its state of immersion.

When the top of a rudder is at the surface its "virtual aspect radio" will be doubled, because, assuming the surface to be flat, the formation of the stream-line flow around the rudder becomes the same as that round the lower half of a rudder of twice its aspect ratio and deeply submerged.

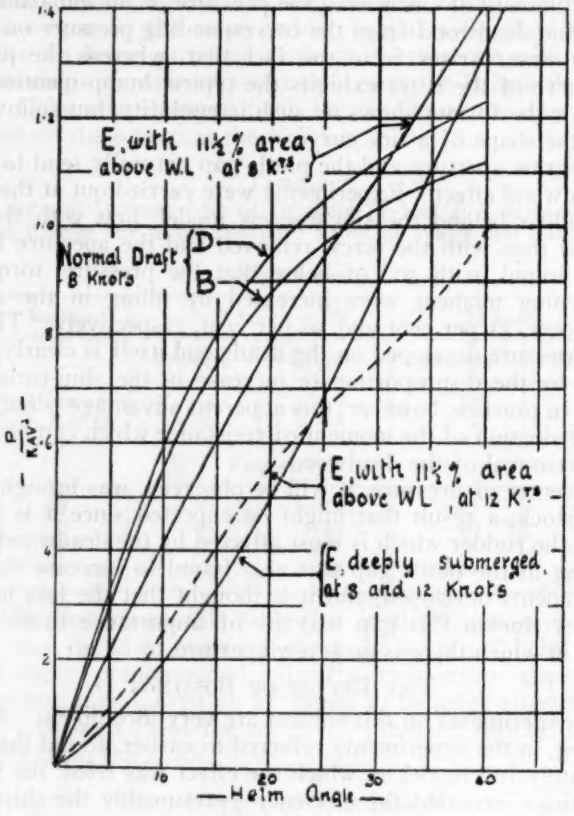

E, with 11½% area above WL, at 8 Kts
Normal Draft 8 Knots
D
B
E, with 11½% area above WL, at 12 Kts
E, deeply submerged, at 8 and 12 Knots
Helm Angle

Fig. 6

Experiments were carried out by Baker with his rudder *E* (Fig. 5) deeply submerged, and with part of its area above water. Fig. 6 shows the results obtained, and similar curves for rudders *B* and *D*, run behind a fin at their normal immersion, are included for the sake of comparison.

These curves point to the following conclusions:

(1) When *E* was at the surface, and its virtual aspect ratio was thereby doubled, it gave better results than when submerged.

(2) Ordinary rudders gave better results than *E*, at the smaller helm angles, owing to their greater aspect ratio.

(3) The dotted curve showing rudder *E* at 12 knots lay entirely below the corresponding curve for eight knots, suggesting that at the former speed the critical speed for maximum wave-making had been passed.

Balanced Rudders

The information available for balanced rudders is more restricted than for unbalanced rudders, but at the same time it is easier to apply to them the data obtained from experiments on planes.

A balanced rudder is less efficient than an unbalanced one, owing to the absence of deadwood effect. Fig. 7 shows curves taken from the results of the experiments of Cowley, Simmons, and Coales already referred to. It will be seen from these curves that

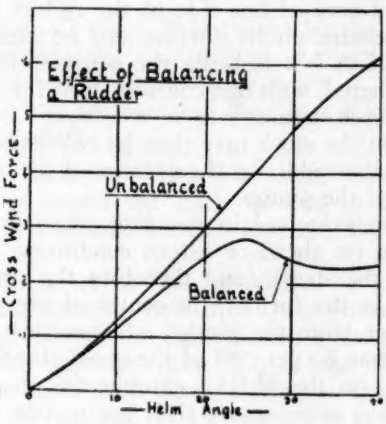


Fig. 7

the loss in efficiency of a balanced as compared with an unbalanced rudder is not great up to about 20° helm, but at large angles is considerable. Note also the characteristic hump on the curve for the balanced rudder, which is absent from the other curve.

The stock of a balanced rudder should be so placed as to equalize, as far as possible, the torque for ahead and stern conditions, due consideration being given to the relative speeds in the two cases.

The Friction of Rudder Bearings

If the torque on a rudder stock be measured by means of a torsion-meter, both as the rudder travels outward and as it returns to the center line, and the results be plotted to a base of helm angle, it will be found that the curves for the outward and inward swings will be separated.

The mean of the two curves will represent the torque necessary to overcome the pressure of the water, while the difference between the mean curve and either of the other two will be the amount of torque used in overcoming the friction of the bearings. The reason for this will be understood when it is remembered that the total torque used on the outward swing is the torque required against water pressure plus the torque required against friction, while on the return swing the torque required is the difference of the same two components.

Denny found that the frictional moment, in the case of a spade rudder, amounted to some 22 per cent of the net twisting moment. The spade rudder, however, is probably the worst type in this respect, but some allowance should always be made for friction in computing the force on the tiller.

The Calculation of the Diameter of the Rudder Stock

The immersed area of one side of the rudder having been calculated, the pressure on its surface can be estimated from the formula $P = K A V^2$, K being the constant for the maximum helm angle, gathered, with due consideration for all the factors of the case, from such data as may be available.

The torque on the stock may then be calculated by multiplying the pressure on the rudder by the distance of the center of pressure from the axis of the pintles.

Care must be exercised in deciding whether the calculations should be based on ahead or astern conditions, for in the latter case, although the speed (and therefore the pressure) is likely to be less than in the former, the center of pressure will be considerably further from the pintles. In practice the speed astern is rarely more than 80 per cent of the speed ahead.

It was found in the N.P.L. experiments that the torque for motion ahead was more severe than for motion astern, provided that the speed astern did not exceed about 80 per cent and 60 per cent of the speed ahead, for the single- and twin-screw models, respectively.

If no appreciable bending moment can occur in the stock, its diameter can be obtained from the formula:

$$D = \sqrt[3]{\frac{61 \cdot 2\,T}{f}}$$

where D is the diameter in inches; f is the working stress, say five tons per square inch for steel or four tons for iron; and T is the calculated torque in tons-feet.

If, on the other hand, the rudder is of such construction that a considerable bending moment may occur, then this bending moment (M) must be calculated and combined with the twisting moment (T) to obtain the "equivalent twisting moment," which is equal to: $M + \sqrt{T^2 + M^2}$; this equivalent moment must then

be substituted for T in the above formula for the diameter of the stock.

Steering in Shallow Water

Baker has investigated this subject both by personal observation in the Suez Canal and by tank experiments at the N.P.L. (See paper to I.N.A., 1924.)

The chief differences which occur in passing from deep to shallow water are as follow:

(1) The stream lines flowing towards the rudder are restricted to a more or less horizontal motion; the relative divergence of the streams is thereby increased, with a resulting increase of eddy-making.

(2) The virtual mass of the ship is increased, due to increased eddy-making.

(3) Instability of flow between the bottom of the ship and the ground is likely to occur.

(4) The deadwood effect is increased by the more horizontal flow of the streams; the ship-turning moment is therefore increased by the increased deadwood pressure.

(5) The speed will decrease and the slip will increase, resulting in a greater race effect.

On the other hand, in twin-screw ships, the greater velocity of the slip stream causes the water flowing to the rudder to be drawn into the screws and thereby decreases the pressure on the rudder.

If the shallow water is also restricted in breadth, as in a canal, considerable turning moments are produced by the water when the vessel approaches either bank, generally producing a sheer towards the opposite bank. To correct this sheer it was found better practice to stop the outside screw than to increase the speed of the inside one, and wrong practice to put the outside one astern.

In twin-screw ships a rudder of type *H* (Fig. 5) reaching the race at a small angle was found to be the best. The screws should be placed as near together as possible in order to avoid the slowing down of the streams between them.

The Rudder under Service Conditions and in Heavy Weather

A paper read before the Liverpool Engineering Society by Miss E. M. Keary, of the N.P.L., gave particulars of a series of tank experiments carried out to determine the fluctuations of rudder torque under service conditions.

The conclusions drawn from these experiments were briefly as follow:

(1) The torque is increased by the movement of the helm as compared with its value when the helm is fixed; this increase may

be about 21 per cent, depending on the rate at which the helm is moving when it passes the angle experimented with.

(2) The torque is decreased when the vessel yaws as compared with when the vessel is constrained to keep a straight course; this decrease amounted to some 26 per cent at 12 knots. If, on the other hand, the vessel is already yawing and helm is used to check this yaw, the torque is increased.

(3) The initial movement of the ship is not very sensitive to the rate of helm movement.

(4) The rate of yawing increases steadily with increase of helm up to 30° and is proportional to the forward speed of the vessel.

(5) The greatest increase in torque due to waves occurred, in these experiments, when the waves were head on and of the same length as the ship. The greatest increase in torque recorded in these circumstances, as compared with smooth water, was nearly 50 per cent.

In this connection it is interesting to note that the waves created in the tank were not so steep as those frequently met with in the North Atlantic. In practice, most cases of damage to rudder, due to heavy weather, occur with a heavy following sea. Three examples of heavy weather strains recorded by a hydraulic apparatus were given in a paper before the I.N.A. in 1884 by Mr. Arthur F. Maginnis, and were as follow:

(1) The ship was on a following sea using starboard helm with a pressure on the rudder of 8.66 tons. As the stern was lifted by the sea the pressure on the rudder was suddenly reversed to 14½ tons in the opposite direction.

(2) In mid-Atlantic, with a heavy following sea, the rudder pressure was suddenly reversed, reaching a maximum of 24½ tons.

(3) In a North Atlantic gale a momentary load on the rudder of 30 tons was recorded, whereat the recording instrument was broken.

A case has recently come before the author's notice of a 420-foot cargo vessel in the North Atlantic trade having had her rudder stock damaged by heavy weather. The stock was 14 feet long by 10½ inches in diameter, and was twisted about 6°.

A permanent twist of 6° might be caused by a succession of comparatively small blows, each straining the material slightly beyond its elastic limit, or by one heavy blow. The officers of the ship were unaware of any one sea having done the damage. One thing, however, can be said with certainty, *viz.*, that the rudder stock was stressed beyond the elastic limit.

It is difficult to find a reliable figure for the torsional elastic limit of forged ingot steel, but for the purpose at hand ten tons per square inch has been selected. From this figure the minimum torque which acted on the stock can be calculated.

Thus $T = \cdot 196\, f\, d^3 = \cdot 196 \times 10 \times 10{\cdot}5^2 = 2{,}270$ tons-inches, or 189 tons-feet.

It is interesting to speculate as to how such a torque could have been produced by the action of the seas.

Having studied the circumstances of the damage, both by the log book and by discussion with the officers of the ship, the author was led to the following conclusions:

(1) The ship was in a following sea amongst waves about 450 feet long and 35 feet high.

(2) Her speed was about 10·2 knots.

(3) Owing to the considerable yawing of the ship before the heavy sea and to the consequent use of large helm angles, the rudder might have been at any angle up to, say, 45° relative to the direction of motion of the surrounding water, at any particular moment.

(4) The speed of the broken water on the wave crest would be at least equal to the speed of wave progression, and the depth of the layer of broken water might be about five feet. The density of this broken water would be slightly less than that of solid water.

Consider a trochoidal wave 450 feet long and 35 feet high.

$$\text{Speed of progression} = \sqrt{\frac{Lg}{2\pi}} = \sqrt{\frac{450g}{2\pi}} = \sqrt{2{,}310} = 48 \text{ feet per sec.}$$

$$\text{Period} = \frac{450}{48} = 9{\cdot}36 \text{ seconds.}$$

$$\text{Radius of motion of surface particles} = \frac{h}{2} = \frac{35}{2} = 17{\cdot}5 \text{ feet.}$$

These particles trace out a complete circle every 9·36 seconds.

$$\therefore \text{Tangential velocity of surface particles} = \frac{35\pi}{9{\cdot}36} = 11{\cdot}75 \text{ feet per second.}$$

The radii of motion of the sub-surface particles are less than of the surface particles. At a depth of 25·5 feet below the surface, *i.e.*, the depth of the rudder when fully immersed, the radius of motion of the particles is about ·7 times that of the surface particles. Hence, the speed of the particles considered in the following calculations is the mean speed for the depth of rudder immersed, and has been taken from a curve constructed for the purpose.

The rudder can now be considered in two cases: (1) at the trough of the wave, and (2) at the crest. Owing to the period of pitching of the ship being independent of the wave period, the rudder may be either deeply or lightly immersed in either position.

Case I.—Rudder immersed to 25.5 feet in the trough.—Here the speed of the rudder relative to the surrounding water = speed of ship + mean speed of wave particles. Speed of ship, 10.2 knots = 17.22 feet per second. Speed of surface particles = 11.75 feet per second.

Mean speed of wave particles = $11.75 \times .84$ (from curve) = 9.86 feet per second. Hence relative speed of rudder = 27.08 feet per second.

From drawings of the ship the immersed area of the rudder was found to be 135 square feet and the mean ordinate 5.305 feet. The C.P. for ahead motion = say, 2.33 feet abaft center of mainpiece = 3.35 feet abaft center line of pintles.

Suppose the rudder is, at the moment considered, at 30° to its relative line of motion, then the K value from Baker's researches = 1.1.

$$\therefore \text{Pressure on rudder} = \frac{1.1 \times 135 \times 27.08^2}{2{,}240} = 49 \text{ tons.}$$

And the torque on the stock = 49×3.35 = 164 tons-feet. This torque gives a stress on the stock of 8.7 tons per square inch, and it should be remembered that the case is a usual one during winter in the North Atlantic.

Case II.—Rudder at the wave crest, immersed 8.5 feet in solid water and 5 feet in broken water:

Area of rudder in solid water = 45.25 square feet. C.P. for motion ahead = 3.4 feet abaft the pintles.

Reduction in speed of particles due to sub-surfaces = .95 (from curve). Mean speed of particles = $11.75 \times .95$ = 11.2 feet per second.

∴ Relative speed of rudder = 17.22 — 11.2 = 6 feet per second. K, as before, is about 1.1 with the rudder at 30°.

$$\therefore \text{Pressure on rudder} = \frac{1.1 \times 45.25 \times 6^2}{2{,}240} = .8 \text{ tons.}$$

∴ Torque due to solid water in, say, a clockwise direction = $.8 \times 3.4$ = 2.7 tons-feet.

The layer of broken water will produce a torque in the opposite direction. Suppose this layer is five feet deep and moving at a speed of 48 feet per second.

Speed relative to rudder = 48 — 17.22 = 30.78 feet per second.

Area of rudder in broken water = 33.75 square feet.

C.P. abaft pintles (for motion astern) = 5.05 feet.

Take the density of broken water to be .9 and the K value as before 1.1

$$\text{Pressure on rudder} = \frac{1.1 \times 33.75 \times 30.78^2 \times .9}{2{,}240} = 14.13 \text{ tons.}$$

Torque due to this pressure in a counter-clockwise direction = 71·3 tons-feet

The pressure due to broken water may be considered as a live load, and therefore a torque of double 71·3 tons-feet, or 142·6 tons-feet, will momentarily be produced. Hence, deducting the opposite torque due to the solid water, the net torque produced will be about 140 tons-feet, which is equivalent to a stress of 7·46 tons per square inch.

Neither Case One nor Case Two produces quite enough torque to stress the stock beyond the assumed elastic limit; therefore the damage must have been produced by an impulsive force.

If the length of the stock is 14 feet from the coupling to the deck bearing, the angle of twist for a stress of 10 tons per square inch may be calculated as follows:

$$\text{Angle in radians} = \frac{2fl}{CD}$$ where C is modulus of rigidity ($= 11 \times 10^6$) and l is the length of stock, f is the stress, and D the diameter of the stock

$$= \frac{2 \times 10 \times 14 \times 12 \times 2{,}240}{11 \times 10^6 \times 10{\cdot}5} = {\cdot}0651 \text{ radians}$$

$= 3°\text{-}44'$.

The work done in twisting the stock $= \frac{1}{2}T \times i$ where T is the torque and i the angle in radians. $\therefore$ Work $= \frac{189 \times 2{,}240}{2} \times {\cdot}0651$

$= 13{,}792$ foot-pounds.

This work is done by the partial destruction of the kinetic energy in the broken water.

Consider a mass of one ton of broken water meeting the rudder with a velocity of 48 feet per second and finishing with the velocity of the rudder, *viz.*, 17·22 feet per second.

$$\text{The kinetic energy lost} = \frac{1}{2} \times \frac{2{,}240}{32{\cdot}2} \times (48^2 - 17{\cdot}2^2)$$

$= 70{,}000$ foot-pounds.

Of the total kinetic energy lost by the ton of water only a part would be extracted by the rudder, but these figures show what a comparatively small quantity of broken water striking the rudder is required to stress the stock above its elastic limit and so to give it a permanent twist.

The Cause and Prevention of Embrittlement of Boiler Plate

Supplement to *The Engineer*, 24 September.—The occasional occurrence of cracks in boiler plates, usually running between rivet holes and sometimes accompanied by the breaking away of the rivet-heads, has long aroused interest and attention in all countries

where high-pressure steam boilers are used. Some research on the subject has, we believe, been initiated by the Board of Trade in this country, while publications on the subject have been numerous, both in America and Germany. Two somewhat divergent lines of opinion have developed in regard to the probable cause of these cracks. Both schools of thought agree that these cracks differ widely from any that ordinarily occur in steel, such—for example—as fatigue cracks or the fractures produced by direct tension or bending, whether under steady load or under impact. All these "normal" types of fracture are "trans-crystalline"—i.e., the path of fracture runs across or through the crystals, and does not follow the inter-crystal boundaries. The boiler-plate crack under discussion, on the contrary, is typically inter-crystalline, and is found to follow the crystal boundaries with considerable accuracy. As was pointed out by Dr. Rosenheim in his contribution to the Faraday Society symposium on what is usually called "season cracking," this kind of inter-crystalline cracking in steel is strictly analogous to the inter-crystalline fractures which are typical of season cracking in brass and other alloys, and it would follow that both are presumably due to similar processes.

In regard to season cracking itself there have been divergences of view. Thus, according to the original views of Rosenheim and Archbutt, failure is due to gradual flow of the inter-crystalline "cement" under prolonged loading, and they suggest that it occurs most readily where the shape of the crystals renders movement along the boundaries easy. In the case of certain aluminium alloys these authors have shown that typical season cracking can occur in circumstances where corrosive influences are excluded, although even in those cases the process can be readily accelerated by the influence even of atmospheric corrosion. On the other hand, the work of Moore and Beckinsale has shown the very great part which corrosion plays in the season cracking of brass. The ultimate conclusion, which may now be regarded as well established, is that typical season cracking is due to the combined action of stress and corrosion, and that it is perhaps only in the softer alloys of relatively low melting point where there is sufficient possibility of flow between the crystals to allow of cracking without the aid of corrosion.

While the suggestion that steel could, under any circumstances, be subject to "season cracking" has been strongly contested, the analogy between these failures in boiler plates and season cracking in non-ferrous alloys is much too strong to be ignored. It has never, however, been shown that in any circumstances steel develops cracks of this type in the absence of some special corroding agent. Quite apart from this view, however, it has been strongly maintained by American investigators particularly, that the cracking of steel in these cases is due to embrittlement caused

by the presence of caustic soda in the boiler water. Various experiments have been made to show that mere contact with soda solutions causes a general embrittlement of mild steel, but the evidence for this view has never seemed conclusive. Embrittlement due to hydrogen absorption, indirectly arising from the presence of an electrolyte such as caustic soda solution, has been demonstrated, but this is a different phenomenon.

The real analogy between boiler-plate cracking and "season cracking" appears, however, to be established on firm ground by an important contribution to the subject coming from Messrs. Parr and Straub, of the University of Illinois, who describe their results in an important paper presented to the American Society for Testing Materials at their meeting in June last. The experiments carried out by these authors consisted in exposing test pieces of mild steel to caustic soda and other solutions at high temperatures—i.e., under steam pressure—while the steel test-piece was kept under load. They find that "embrittlement occurs—i.e., the steel test-piece breaks under the load with the formation of inter-crystalline fractures and without ductile extension, provided that two conditions are fulfilled. These are: (1) That the load exceeds the yield point of the steel; and (2) that the concentration of the caustic soda solution is not less than 350 grams per liter. It would thus appear that failure of the type in question can be brought about at will by the combined action of a sufficiently high stress and a sufficiently intensive corroding agent of a particular kind. The American authors claim that this solves the problem and accounts for the failure of boiler plates in service. This may well be a true conclusion in regard to those cases where such conditions as specified may occur, but it seems very doubtful whether these conditions can really exist in all or many of the cases where boiler cracking is encountered.

The attainment of working stresses well above the yield-point of the steel, even in the vicinity of rivet holes, is not easily accounted for, unless to the working stresses of the boiler, which are comparatively low even near the rivet holes, must be added heavy self-stressing due to excessive riveting pressures or to the forcing of the plates during construction. If such very high stresses are an essential causative factor, then there should be little fear of trouble of this kind in a well-designed boiler in which heavy internal stresses are avoided by careful and workmanlike construction. As regards the concentration of caustic soda required—which is exceedingly high—it is not suggested that this can arise in the boiler water itself, but that it occurs where the boiler water is a dilute solution of caustic soda and finds its way into narrow spaces between the laps of the boiler shell, there evaporating and becoming sufficiently concentrated. Such a process may be possible in certain cases, but it must be pointed out that after such a high

degree of concentration only a very small volume of solution can be left in contact with the steel, and that this would be rapidly exhausted by its action on the steel. A process of alternating renewal of the solution and concentration to the dangerous limit must be invoked, and this presupposes somewhat special conditions. There is also the well-established fact—not considered by the American authors—that cases of typical "embrittlement" have been known to occur in the steam-drums of water-tube boilers where it is difficult to see how access of solution and subsequent concentration can occur.

While, therefore, it may not be safe to conclude that the whole problem has been solved by the work of Parr and Straub, yet their contribution places the matter on a secure foundation up to a certain point. Their conclusions emphasize the need for eliminating serious internal or self-stresses from boiler construction and also suggests the wisdom of securing the presence in the boiler water of sufficient sulphates, which—they find—inhibit the action of caustic soda in this respect. It has yet to be discovered whether there may not be other corrosive agents, liquid or gaseous, which may play a part in assisting or accelerating this type of "season cracking" in mild steel. Although the other solutions tried by Parr and Straub gave negative results under their conditions, the possibility that other substances may play a part cannot yet be set aside.

Riveted and Welded Joints in Boiler Construction

Engineering, 1 October—Whenever new methods of construction of any type of engineering plant become available, it is necessary to exercise caution before their general application is advocated. This applies particularly to cases where the stresses to which the parts are subjected are of considerable magnitude, or are of an alternating character. For many years, riveting was the sole means of connecting the curved steel plates used to form the drums of boilers. Welding, both by the use of an oxy-acetylene blow-pipe and by means of the electric arc, is now commonly used in repair work, and also in some types of constructional work. It has been thought by many engineers that these processes might be applied with success and economy by the boiler-maker. Before any general adoption is possible, however, it is necessary that the results of tests conducted by strictly impartial investigators, should be available. Much work of this nature has been done by many different authorities, but unfortunately the results have not always been made available for study by the general engineering public. We therefore welcome a report of the work done by M. E. Hoehn, the chief engineer of the Swiss Association of Owners of Steam Boilers. This report bears the title "Rivure et Soudure des

Chaudières à Vapeur," and in it comparisons are made of the characteristics of boiler drums forged in a single piece, with those having riveted and welded joints of various types, either separately or in combination. In his introductory remarks, the author states that he would not have undertaken further work on riveting, so much of which has already been done, if he had not been able to use a new method of determining the state of tension in the riveted construction. This consisted in measuring, by means of extensometers, the expansion of the plate and of butt-straps on the test bars and on the various riveted joints used in boiler construction.

The conclusion arrived at by M. Hoehn, after his investigations were completed, was that, without doubt, the boiler drums affording the greatest security against rupture were those forged in a single piece, without any seams, and with hemispherical ends formed in a die press. It was known, however, that electrically-welded joints possessed great strength and it ought to be recognized that riveting of hemispherical ends to seamless cylinders should be allowed, within certain limits, if the edges of the drums and ends were electrically welded. The ends could be riveted to the drum with a single-riveted lap joint, even when the thickness of the material was great, for, in a circumferential seam, the bending moments were much less important than in a longitudinal riveted joint. It was also possible, when the thickness of the metal was not very great, to use butt-welded joints between the ends and the drum, either made by the use of the blowpipe or with the electric arc, if the joint were reinforced by butt straps, welded at intervals to the drum and ends. In one system of construction, drums were welded to the ends with water-gas. In this process, the drums were subjected to a hydraulic test pressure which was sufficient to ensure that the tangential tension attained 1,500 kilograms per square centimeter (or 21,330 pounds per square inch); after testing, the drums were annealed. By this means very great solidity was obtained.

Boilers and other vessels, when the walls were not very thick and when high test pressures had not to be used, might be welded either with gas or electricity. For the purpose M. Hoehn proposed the use of a reinforcement consisting of butt straps electrically welded at intervals to the two parts, which had been butt-welded. In tests, it had been found that these butt straps invariably broke before they were pulled away at the welds. As their use augmented the section of the welded joint, and consequently the moment of resistance, the bending moments were reduced in effect. Joints, reinforced in this way, had been shown in tests invariably to give way in the plain plate. Both gas and electric welding were certain to have extended use in the future and to prove cheaper than riveting. Their principal fault was that they

were more dependent than riveting on the experience and conscientiousness of the workman. A preference was indicated in the report for the use of flux-coated electrodes, and it was also suggested that the work could best be done with a continuous-current electricity supply.

It had to be admitted that, when plates were riveted together, slip took place if heavy stresses were applied. In the experimental work done by M. Hoehn, it was found that there were two kinds of displacement of this character: the internal and the external. The first was due to the unequal extension of the plates and the butt straps, and resulted from the fact that the rivets in different rows were subjected to different loads. The external relative displacement of a riveted joint was due to the deformation of the rivets, either elastic or permanent, at the edges of the holes. The elastic state of a riveted joint could be completely modified when butt straps were introduced, the edges of which were welded to the plates. In that case, the welded joints were the important ones. Riveted butt straps at welded joints had not, however, the same efficiency, unless their breadth was great and their thickness was sensibly greater than that of the plate. In dealing with this case, double butt straps were the only ones considered, as butt straps on one side of a joint were regarded as bad practice. It was suggested that, in future, butt straps should always be welded.

The tests showed that, in the riveted longitudinal joints of boiler-drums, the bending moments were greatest at the edge of the butt straps. In a single-riveted lap joint, they were shown to be a maximum at the edge of the plate. It was particularly in the case of riveted joints with double-or treble-riveted butt straps, and with one row of single-shear riveting, that the bending moment actions were pronounced. In single-riveted lap joints, the bending-moments had greater effects than tensile stress. In the future, the conditions under which single-riveted lap joints would be approved would become more severe, and the factor of safety used in their design would need to be increased. One fault of double butt straps with double- or treble-riveting, one row of which was in single shear, was the existence of bending moment actions, as already indicated, but this system of construction possessed a certain flexibility, because the thickness of the total section changed gradually from that of the plate to that over the butt straps, as well as on account of the chamfering, due to caulking, or the welding introduced to secure freedom from leakage, which were not in line on the two sides of the plating.

New methods were proposed by M. Hoehn, for the study of riveted joints and the calculation of their resistance, as it was necessary to take account of conflicting requirements. On the one hand, the equal distribution of shearing load in a riveted joint

demanded, in the first row, a close pitch, while, on the other hand, the resistance of the plate, which was a most important consideration, demanded wide spacing of the rivets. It was necessary to aim at getting equal distribution of the tensile stress in the plate between the rivets of different rows. It was proposed, in order to attain this object, gradually and regularly to reduce the shearing forces to which the rivets in each row were subjected. The loads on the rivets, especially in double-shear riveting, comprised bending moments and shear actions; bending was mainly produced in the first place and shearing came into action later. In the future it would be necessary to know, not only what factor of safety was used in designing a riveted joint, but also the method used in calculating the resistance of the joint, to determine whether the calculations of the thickness of plates were made on a uniform basis. It was suggested by M. Hoehn, in conclusion, that joining metal plates by welding was the most natural method, resulting in an elastic state which was simple. Riveting could only be regarded as an artificial expedient.

AVIATION

Huff Daland "Cyclops" Described

U. S. Air Services, Oct., 1926.—The Huff Daland Company has just finished the world's largest single-engine plane at their plant in Bristol, Pennsylvania. This is the Huff Daland *Cyclops,* one of the newest designs of high performance bombers for the Army air corps. Up to the present time this machine has been known as the "mystery plane" of the Army. It was shown to the public for the first time on August 11 at the factory in Bristol. Miss Eleanor G. Godley of Trenton, New Jersey, christened the plane *Cyclops* in the customary and fitting manner.

The *Cyclops* is 60 per cent larger than the Huff Daland *Pegasus,* which won the Detroit *News* Air Transport Trophy during the 1925 air races at Mitchell Field, and is constructed along somewhat similar lines. It is desinged to be powered with the new twenty-four cylinder, air-cooled 1,200 h.p. engine now being constructed by the Air Corps Engineering Division at McCook Field. Until this new engine is completed the big bomber will be flown with a Packard V2500, 800 h.p. engine, 400 h.p. less than the proper powerplant.

When in service the *Cyclops* will weight 17,000 pounds and be able to carry a useful load of 9,000 pounds. She will carry a crew of six, mountings for ten machine guns and racks for either one 4,000-pound bomb, two 2,000-pound bombs, or four 1,000-pound bombs. The machine has a span of 85 feet and an overall length of 65 feet. The high speed will be around 135 m.p.h. and

fuel for twenty-four hours' flying will be carried. This performance and weight-carrying ability will make this machine a powerful weapon. Loaded with gasoline this big plane should easily make a New York to London flight.

The structure is all-metal, being made up of welded, seamless, chrome molybdenum steel tubing. This construction is a new development by Mr. C. T. Porter, the designer of the *Cyclops*.

Under proper heat treatment this material has a tensile strength of 200,000 pounds per square inch. The wing spars are built up in a very simple fashion. Two long tubes, running the whole length of the wing, form the upper and lower flanges of the spars. The spar web is built up of short tubes of the same material. The wing ribs are built up of duralumin tubing in a somewhat similar fashion. A rib of some fifteen feet in length can be built to carry hundreds of pounds of load and still weigh only twenty ounces. The advantage of the metal construction is the fact that these wings can be stored for long periods of time without depreciation. The upper wing is carried on a steel tube cabane with two adjustable flying struts of steel tubing and the lower wing panels are attached to two wing roots on the fuselage. Ailerons are fitted to both wings.

The landing gear is of the Huff Daland double tripod type which eliminates the axle between the wheels and the consequent danger of fouling and nosing over in tall grass or grain. The shock absorbers are of the *Oleo* type, eliminating the usual rubber shock absorbing cord. The *Oleo* shock absorber is made up of two cylinders, one fitting closely inside the other. In the smaller cylinder there is placed a heavy steel spring, which is kept immersed in oil. The shock absorbing unit can be taken down by removing a single bolt, and the whole undercarriage can be removed by undoing four bolts. The tail skid is steerable.

The fuselage is of welded seamless tube steel construction throughout, without bracing wires. While alignment problems during manufacture presented unusual difficulties, they are more than compensated for by the rigid structure obtained which does away with the necessity of realignment due to hard usage or to climatic changes.

The development of this new bomber marks the culmination of a long series that started in the early stages of the World War, said a representative of Huff Daland Airplanes, Inc., recently.

It is true that experiments in dropping high explosives were made before the war, both in the United States and abroad, but no specialized planes were built. In the early days of the war, bombing was done in a very desultory way and it was a couple of years before real bombing planes began to appear in any numbers. At that time they were accustomed to fly at very low altitudes

and to do their work mostly at night for this reason. While there were special bombing planes, most of the observation types were also fitted out as bombers: for example, our own *DH4*.

The development of pursuit planes and anti-aircraft artillery forced the bombers to seek higher altitudes and to be protected by friendly fighters. It also became evident that larger and larger bombs were required to be really effective. This, in turn, required larger and larger machines, and as a result both sides produced multi-engined designs early in the war. At the close of the conflict, the standard bomber in all air services was a twin-engined biplane. Four and six engined types were experimented with but were not used extensively at the front.

Another factor in the wartime development of bombing aviation was the attitude of the allied high command. At that time, and it is still largely true, today, the various general staffs were unable to visualize the use of aircraft for any other purpose than "to assist the advance of the infantry." During the year 1918, however, an independent bombing group with the latest heavy bombing equipment was formed for the purpose of acting directly against the enemy. The group was composed principally of British personnel and material. It directed its efforts against the German munition plants along the Rhine and was effective in interrupting production. During the summer of 1918, "super" bombing planes were built to carry on "retaliation" bombing raids on Berlin. An example of this type of machine was the four-engined Handley Page. The Armistice was declared a few days before any of these raids were started.

Immediately after peace was declared there was little development in new types. Every government was swamped with thousands of surplus aircraft and in many cases they had large stocks of the latest designs which had never seen service, some being delivered after the war was over. For the first two or three years the building programs were modeled closely on those in vogue during the war.

The first progress resulted from the tests in bombing battleships.

The contemporary development of pursuit planes demonstrated the need of faster and higher-flying bombers. To gain speed it is necessary to "clean up" the structure. This is difficult to do with a multi-engined design and attention was accordingly directed to single engined machines capable of carrying at least one 2,000-pound bomb. At the time this development began, there were no engines large enough to do this work. Development was then directed to the production of larger engines. In approximate order they were the Wright *Tornado* 650 h.p., the Packard *2A-2500* 800 h.p., and now the air corps twenty-four cylinder 1,200 h.p. The 1,000 h.p. Napier *Cub* built in England has been

incorporated in several heavy bombers for the Royal Air Force.

The bombing airplane is practically the only type of military plane that is readily convertable to civil uses. The Huff Daland Company announces that it has gone into this question carefully and is prepared to supply either the *Pegasus* or *Cyclops* models, equipped to carry passengers or freight. Inasmuch as the *Pegasus* carries a useful load of 5,000 pounds and the *Cyclops* about 9,000 pounds, the manufacturers point out that they would be capable of carrying twenty or more passengers at a cruising speed of well over one hundred miles an hour. The great load-carrying ability of these giant bombers will enable them to cover long stretches and still carry a worthwhile pay load, either of bombs or commercial freight.

There are other advantages in a commercial plane along the lines of the two Huff Daland bombers beside weight carrying. The necessarily large fuselage insures a large, commodious cabin—always an important factor in a commercial machine. The *Cyclops*, in fact, is so large that there should be no difficulty in fitting it up with berths for an overnight service. The demand for clean lines in the structure has resulted in a single bay, biplane construction for both the *Pegasus* and the *Cyclops*. This construction is said to be simple to take care of and store and should, therefore, effect marked operating economies.

Some Notes on Bombardment Aviation—Maj. Wm. D. Tipton *U. S. Air Services*, Oct., 1926.—In a previous discussion one sought to point out that pursuit aviation by reason of the protective duties devolving upon it should be divided into two classes, defensive and offensive. The outstanding attributes of the defensive or interceptor fighter were high rate of climb and extreme maneuverability; of the offensive or hunter type, high speed, great strength and diving power. To attain the outstanding attributes of the interceptor the air-cooled radial suggests itself, and in case of the hunter one feels that the water-cooled type lends itself better to streamlining and to the demand for "overrevving" than does the radial.

The interceptor was picked as the logical type for bombardment escort and as the basis of this aforementioned discussion was the division of pursuit types due to the demand for certain classes of protection, it seems logical to examine the bombardment setup. We shall consider three phases: design, performance and tactics.

All air corps textbooks say the outstanding feature of a bomber is weight lifting. Speed, maneuverability, and climb shall be obtained after the weight lifting characteristic is satisfactory. Right here this writer desires to take exception to this thought. In one's humble opinion our services have dwelt too much on weight carry-

ing and too little on performance. Of what avail is a bomber which can get off with a huge load if it can not put up a performance somewhat comparable with its antidote—the enemy pursuit? Furthermore, one would like to take this opportunity to examine the newest stunt in bombardment aviation, the big single-engined bomber.

One had the opportunity while at summer camp at Langley Field to observe the antics of our newest single-engined bomber and to hear the pilots on the subject. Obviously to a man they are against the idea. Let it be clearly understood that this is not in criticism of the airplane. Pilots are very enthusiastic about its performance and flying qualities. It is designed to carry 2,000 pounds using an 800 h.p. geared engine swinging a 16-foot propeller. The first impression one got was that of all airplanes that fly it would be the easiest to shoot down. Its forward protection is two fixed guns. Imagine trying to put the guns of a big bomber on a pursuit plane. The pursuit attack from the fore quarter would find absolutely no return fire. It would seem that until some method of obtaining a field of fire forward which would well overlap the field of the aft guns is found, it is useless to build single-engined bombers.

The next tendency which seems bad from a tactical viewpoint is the consistent overloading of bombers which our services have practiced. There is too much disparity between the performance of bombardment and pursuit. Of course this disparity will always exist, but there is no reason why bombardment speeds should not be much closer to pursuit speeds than they are. In the late war there was little difference, and yet bombardment suffered miserably, especially in the American service. Probably the most ghastly sight one remembers was the fight between five *DH's* and a formation of Fokkers, witnessed while on the German side as a guest of the government. This bombing formation was jumped and every plane shot down, most of them in flames, inside of ten minutes. Perhaps some of those fancy clear-the-air-with-pursuit ideas were at work. Certainly no serious effort was made to provide escort for no American pursuit was in sight and the fight occurred not more than twenty-five miles behind the lines near Metz.

There has been much talk lately about bombardment protecting itself by close formation flying and gun power. To expect a modern American bomber formation to protect itself is asking too much. Watch one of them staggering along and remember that it has no more rear gun power and much less maneuverability than the *DH* formation above mentioned. To get any measure of protection there should be twice as many guns aft as is customary. Furthermore, the individual units must have more speed than we

are now building into our new series of bombers. These characteristics may be obtained if our bombardment experts will forget that the chief characteristic of a bomber is weight lifting.

Let us chronicle a few characteristics of the ideal bomber. First, to the ash can with the single-engine idea. The lightest bomber should be able to lift 2,000 pounds. There is little use of building anything that will carry less and a bomber which must carry this load can not be maneuvered easily enough to do anything with fixed front guns.

Nothing less than a total of 1,000 h.p. in two engines will suffice for our bomber. We would use the air-cooled radial because of its lighter installed weight, something like the Pratt and Whitney *Hornet* or the new 500 h.p. Wright radial which will soon be out. Why anyone would want to use a water-cooled engine in the face of these new radials which are coming out is a mystery. Of course one recognizes that the Army has the Liberty indigestion with this huge stock on hand, but we are seeking the ideal and not the expedient.

In each engine nacelle there would be a gunner's cockpit so that twice the gun power utilizing the advantage of cross fire under the tail could be brought into play. Why in this day any one should persist in putting a mountain of tail planes and fuselage between the rear gunner and his target is a mystery. This idea of twin-gunner cockpits, so far as one can discover, was evolved by another prison camp guest of Germany, former Lieutenant Bryant Woods. To amuse ourselves a small group would hold amateur airplane design competitions and Woods specialized in the bomber and one night sprung this twin-rear cockpit idea. This was in the fall of 1918 and our experts have just begun to talk about it.

Nothing less than 150 miles an hour would satisfy us for this ideal bomber and if 1,000 h.p. would not push a bomber with a 2,000-pound load through the air this fast, we would await the development of bigger air-cooled radials before calling this bomber an ideal one.

Superchargers would be installed of course. We can not have too much performance. This bomber would have to make 25,000 feet with its load, for while we may not bomb this high it is going to be necessary to get this high to get over enemy pursuit some time. One may be accused of over-emphasizing performance while at the same time calling for pursuit protection, but one remembers how the *DH's* of the British naval wing near Dunkirk used to laugh at Fokkers because they could go higher and faster than anything current at that time on the enemy side.

The range of a bomber is rather a moot question. Two hundred and fifty miles seem about as far as anyone has asked a bomber to go with full load and return. It certainly seems far enough for

the present. In a land war there will be a lot to destroy in an area two hundred and fifty miles back of the lines provided, of course, that our current pursuit experts have "swept" the enemy pursuit from the skies. In a naval war no one is going to send bombers two hundred and fifty miles away and ever expect them to find their carrier before their gas is exhausted. Again, it is useless to send unprotected bombers anywhere against an equally powerful enemy for a concentration of enemy pursuit will certainly await them.

It would seem that a bomber that could operate 250 miles from base would have sufficient range. At that, if a naval enemy one hundred miles offshore can not be eliminated before it makes contact with our coast defense, there is little likelihood that it could be greatly worried two hundred and fifty miles offshore.

As to bombardment tactics one has yet to hear a convincing argument that anything has changed the situation obtaining in the late war. One had considerable experience in bombardment escort work in cooperation with Royal Air Force, bombardment squadrons attacking a very important German target—the submarine bases at Zebrugge and Bruges. The Germans simply did not want these points bombed and consequently when the air bombardment began too hot they moved some of their crack pursuit squadrons to this area. Bombardment began to suffer heavy casualties until one day it was decided that some sort of protection was needed. The wing commander decided that our squadron of Camels should do an offensive patrol on the line Zebrugge-Bruges and "clear the air" until the bombers arrived. These two points were thirty miles behind the lines.

This writer drew the job of leading the first of these patrols. Thinking that the only way we could get to Bruges without attracting all the pursuit in the area was to go over high, we pushed those Camels up to 20,000 feet where they fairly staggered. Unfortunately, about half way over we mixed up with a flight of Fokkers and by the time the fight was over and our scattered formation collected all thoughts of an offensive patrol fifteen miles further over were lost. The bombers were attacked with some casualties.

We then suggested to the wing commander that close protection would work better so it was arranged that we should meet the bombers at 15,000 over their airdrome and stick by them. We flew about 3,000 feet above them with our patrol flying in threes. Incidentally, this formation practice was initiated by our squadron, the Seventeenth American then brigaded with the British, and was found to work well. As the target was neared the pursuit would draw off to one side and meet the bombers after they had passed over the target.

Time after time we were attacked but rarely, if ever, with casualties to the bombers. We did suffer and inflict casualties, but the enemy, distracted by the combat rarely ever got to the bombers who were flying in close formation ready for the attack. The usual setup of the bomb raid was fifteen bombers and fifteen Camels, and it was the extreme maneuverability of the Camel that made it posible for us to accept combat under odds with success and still maintain contact with the bombers. It rarely happened that odds against us were so great that a part of the enemy pursuit would leave the fight and go after the bombers. If the enemy exhibited an inclination to attack in echeloned flights we would adopt the same tactics.

In one highly gratifying instance, as a result of strong enemy resistance, it was decided that a little trick be played on the Fokkers who were seeking us out in increasing numbers. A second pursuit formation of Bentley Camels of much better performance than the LeRhones was sent about 3,000 feet above us. On one raid they dropped on the attacking Fokkers with disastrous results to the Germans. There seemed little difficulty in meeting the various forms of attack on the part of the German pursuit. At any rate it seemed worthwhile to divert the Fokkers by a little plain and fancy dog fighting which took much of the zest for further fight out of them.

The British bombardment people were enthusiastic about the protection furnished by our squadron, the Seventeenth, and our sister squadron, the One hundred forty-eighth, also mounted on Camels. This escort episode was a most interesting one. The idea thus remains that what happened then may very well happen again. Our pursuit percentage is 60, and there should always be available enough to furnish real protection for bombardment, for after all pursuit exists for something else than the manufacture of aces and D. S. C. recipients. The talk of clearing the air of enemy pursuit is against all experience. Suppose the enemy pursuit is just as strong and somewhat averse to being cleared? The Fokkers were not for a moment cleared from the skies on the Western Front in spite of three major air forces working on them. They were always on hand to shoot our lumbering *DH's* down like flies, other reports to the contrary notwithstanding. One knew some of the *DH* pilots who survived, and they were unanimous in declaring that pursuit tactics of those days failed to protect.

One has elaborated considerably on bombardment escort, for our own tactics assume that our pursuit is going to clear the air so that other aviation may work unmolested. A wise enemy is not going to send his pursuit up if he be weaker while this clearing parade is going on. Anticipating the objectives of the opposing bombardment he will defeat it in detail, and this applies equally to naval

action. There can be no clearing of the skies in such action for everything will be pointed towards getting the bombers to their objective and one force will have to defeat the other's pursuit before the bombers can be brought into play; and even then the bombers will need close escort for it is surprising how a defeated enemy can turn up at the most embarrassing moments.

To summarize this discussion the writer feels that our bombers are being overloaded. They have not sufficient performance nor gun power. They lack maneuverability. Who will not remember the story of that famous mock fight in one of the R. A. F. pageants between the Boulton & Paul *Bugle and two SE-5*s? The *Bugle* doing wide loops causing the *SE's* to fall out of theirs in trying to follow through was a star turn according to reports. This bomber possessed the comparative maneuverability and performance which makes bombardment a real threat, as did the twin Liberty *DH-10* which just failed to get into the war and which is handled like a single-seater. Our tendency seems to be to so load the bomber that exhibits a measure of performance until that performance is lost.

As to tactics, one holds a brief for close protection instead of these fanciful "clear the air" parades. They did not work in 1918 and there seems little reason why they should be more successful in the future. Of course, close protection can not be obtained when the objective is outside of the range of the pursuit, but attacks in the face of enemy pursuit should be escorted by pursuit.

The End of A Great Flight

Aviation, 11 Oct.—On the completion of his third aëronautical triumph, Alan Cobham, the well-known British long distance pilot, arrived back in London, from Melbourne, Australia, after a flight of a total distance of approximately 26,000 miles, on the afternoon of October 1. If there are any who have some misapprehensions as to the real value of long distance record breaking flights, they should look to this last achievement of Cobham for some enlightenment. Alan Cobham does not go in for spectacular flights as such. Nevertheless, his trips are all spectacular because of the care with which he carries his undertakings to success. His aims have always been to demonstrate to the world at large and to the people of his own country in particular, the possibilities of long distance air navigation lines. And he carries out these aims with the certainty of clockwork.

The story of Alan Cobham's London-Melbourne-London flight is one which, for many years, will be read with a deep thrill of admiration from the entire world aëronautical community. It will tell how he set off from the old world town of Rochester when the

English countryside was bathed in warm June sunshine. Entering the Mediterranean, he continued on into the scorching heat and across the vast plains and deserts of Arabia encountering sandstorms, heat, and rain. It was in the Iraq Delta that Mr. Cobham lost his mechanic and trusty friend, Elliott, who was shot from the ground by an Arab. Sergeant Ward of the Royal Air Force took Elliott's place and the flight to Australia continued. Almost inconceivable difficulties were overcome in India where the flight was carried on through the heavy monsoons. It was during this part of the outward flight that the fliers were not heard from for three or four days. Cobham pushed on, still fighting storms and finally reached Rongoon. He arrived at Melbourne on August 15 and left again on the return flight on August 29, intending to dash home, but severe monsoon storms made his flight slow in the vicinity of Burma.

What has been learned from the flight it is perhaps a little early to discuss. It is significant that, for a flight half way around the world, Cobham chose to employ a seaplane, indicating the possibility that with the exception of those air routes which serve one continent only such as the airways system of this country and of Europe, the great trunk airways of the world will be operated with large seagoing planes. It is too early to draw any definite conclusions on this but the possibility is certainly indicated by Mr. Cobham's flight. Then again, there is no doubt that air-cooled engine proponents will look with considerable satisfaction on the successful conclusion of this flight for it is certainly a triumph for this type of aircraft engine. It is significant too that, in his last long flight, that from London to Capetown and back, Cobham chose an air-cooled engine.

Alan Cobham has employed the identical airplane on each of his last three great flights, London-Rangoon and back, London-Cape Town and back, and London-Melbourne and back. The total mileage of that de Havilland 50 must be very high but the variety of extreme weather which it has passed through without severe deterioration is a far more significant feature, and will serve to give some indication of the life of a commercial air transport machine.

It is estimated that Alan Cobham has flown approximately 500,000 miles in his extended air journeys. He has announced that he would never give up flying but will take a well-earned rest by lecturing in the United States. When he arrives in this country he will be welcomed as one of the best known figures in the realm of flying. He deserves universal approval for his achievements in fostering the development and extension of air transportation.

Review of the Status of Naval Aëronautics

Marine Rundschau.—It has become impossible to treat of naval policy, naval budgets, ship construction, and the activities of the fleet without including air navigation in our considerations. As things now stand, it is impossible to form a correct idea of the relative strength of the fleets of different nations without an exact knowledge of the development of air navigation. This applies not only to the special air forces which are attached to the navy but also to the general development of aviation in all its branches, because this latter is gradually acquiring an increasingly powerful influence on the naval armaments of all countries.

At the present moment it is an open question whether seacoast defense can be more effectually assured by naval or aerial armed forces; whether coast artillery is more efficacious than bombing airplanes; whether preference should be accorded to the airplane carrier or to the usual type of ship. Opinions are divided upon all these subjects between the representatives of the older and the younger schools. The present conditions are such that, besides being bound by mutual agreements, the great powers are very cautious about building new types of ships, none of them having any desire to pay the price for experiments by which other nations will profit. Consequently the decrease of naval ship construction runs parallel with the growth of the air weapon. Supremacy on the seas has ceased to be dependent upon the efficiency and number of ships, and the extraordinary development of the air weapon with its unparalleled variety of possibilities has completely obscured the question of the superiority of naval power, which had hitherto been clearly and plainly defined by a power standard. Aviation as a weapon of war has opened out an untrodden field of tactical and strategic possibilities. By using single individuals instead of masses and by embodying the principle of "small stakes and powerful effects" it has increased the significance of the imponderable and indefinable factors of naval warfare to such an extent that we are at present hardly able to form an adequate judgment as to the probable issue of any naval action.

This uncertainty is the cause of the nervousness and vacillation prevailing in all questions of armament. Our former standards of estimate have become worthless; we have no formula for the determination of military values. One point, however, seems to be clear: The aerial weapon can not decide the issue of a war. It is of no use for the occupation of enemy territory; but on the other hand it is the most efficient weapon of defense and of inestimable value for the weaker combatant because the other side has no choice but to follow the lead of its weaker opponent. Air forces can only be repulsed by air forces, and if France, for instance,

builds a powerful air fleet, England will be obliged to do the same, with the result that, owing to financial limitations, she will have to restrict her naval ship construction, much against her own will.

The rate of development of the airplane—both as regards number and quality—outruns by far that of ship construction, and the rapidly growing destructiveness of the aerial weapons of attack has reduced the term of the military efficiency of warships to so short a period that a warship may become obsolete before it is completed. Obviously the military risk involved in the construction of a warship increases with the time needed for its completion; therefore the larger the ship the more hazardous it becomes to build it.

It is an open secret that the naval policy pursued by France can be expressed in two words—submarines and aircraft. The structure of the numerically inconsiderable French Navy is governed by this strategic and tactical principle, which is fully justified by France's geographical position, the range of action of the above-mentioned weapons being sufficient for the waters lying off the French coasts, the channel and the Mediterranean. This is a striking instance of the influence of geography on the structure of the navy.

It is comprehensible that aerial armament has become the subject of vehement discussion in all naval budget commissions and that all countries show an unhesitating willingness to make great financial sacrifices in order to promote its development. The necessity of air forces for the navy and the importance of a close cooperation between the two is insistently advocated by British and American naval authorities. No ship and no navy can be regarded as adequately armed unless it is provided with aircraft. These latter form as indispensable a part of naval armament as guns or torpedoes and they must be accorded an equal place in naval equipment. In order to command a fleet, a naval officer must have as complete a knowledge of the functions and activities of aircraft as of those of torpedoes and submarines. The naval air fleet must become an inalienable part of the navy. The special functions of the air fleet are defined as follows: Flight practice in cooperation with other naval units is vitally important for the training of the fleet. Naval aviation is a special branch requiring not only the comparatively simple knowledge of oversea flight but also that of the very complex problems of the adaptation of aircraft to the practical conditions of naval warfare. Considerations of attack and defense in naval maneuvers require that aircraft should be available for use at a distance of 1,000 miles from their land bases; their operations must be planned out in close connection with those of the fleet and it must be possible to launch them from surface ships. The equipment of the air forces for the above mentioned

purposes of attack and defense must include their stowage, service, and repairing on board surface ships, as well as the mechanical details for their reliable operation over water. The most important question of all, however, is the training of the personnel both in the air and on the water. The chief functions of naval aircraft may be enumerated as follows: (1) observation of ship artillery fire; (2) scouting, observation, and reporting of the movements of the enemy fleet; (3) bombing in cooperation with the naval command; (4) torpedo operations singly and in cooperation with torpedo-boat and submarine attacks; (5) action against enemy aircraft; (6) patrolling of naval escorts; (7) protection of naval bases; (8) training of flyers; (9) various minor functions. The most important of these operations is bombing, which is qualified in the following terms:

"At the present time [end of 1925] the airplane has attained a degree of efficiency which qualifies it for bombing attacks not only against smaller ships but also against the largest battleships. It is probable that airplane construction and bomb production will improve more rapidly than anti-air defense or the underwater protection of battleships. It is a general rule in aviation that today's highest records are no more than tomorrow's average performances. The bomb is the airplane's chief weapon of attack and a bombing squadron is the nucleus of an air force. It is therefore of the highest importance to apply all our efforts to the development of the bombing airplane and the improvement of bombing technic."

The growing application of this new weapon will obviously have an enormous influence on all naval problems relating to ship construction, navigation, strategy, and tactics. This influence is chiefly manifested in the development of the airplane carrier—a new type of ship which has been especially perfected in England. The experiments made in that country have shown that the most suitable type of ship for this purpose is that of 14,000 to 18,000 tons. The United States will shortly complete the construction of the two largest existing airplane carriers (33,000 tons) whose efficiency will have to be tested by experience. France is building an airplane carrier whose completion seems to be delayed by the desire to profit by the building experience of other countries.

Great Britain has two airplane divisions consisting of sixty-one squadrons, besides a number of training divisions. These squadrons are stationed in the southern and eastern districts at distances not exceeding fifty kilometers from the coast; they have a speed of 120 to 250 kilometers per hour and can successfuly repulse attacks at heights of 2,000 to 6,000 meters, provided the warning signal is given thirty to forty minutes previously. London is provided with even more favorable conditions of defence. The actual

strength of the British air forces consists at present of 33½ squadrons for home defense, 9 squadrons for the naval air fleet, and 18½ squadrons distributed in foreign stations. Each squadron consists of twelve airplanes. Special bombing airplanes for coast defense are being constructed, each of which will carry two 1-ton bombs. The smaller scouting airplanes carry a bomb weight of 600 kilograms to a height of 5,000 to 6,000 meters.

France.—The unsatisfactory progress of aviation, which was especially noticeable in the last maneuvers, was much commented upon in the course of the naval budget discussions. Last year's appropriations had amounted to fifty-four millions for new constructions and an almost equal sum for upkeep and other needs; but the fact that these large sums have even been expended was a proof of the backwardness of French aviation. There is no doubt, however, that France has made very considerable progress both in technic and in flight performance. She attaches such a high importance to this special class of weapon that the creation of an air force large enough to satisfy her ambitions will undoubtedly require some time. The development of the naval air forces has not hitherto held pace with that of the army air forces, but it is probable that in the coming year the first proposed stage of progress will be attained—namely, the air forces will be brought to a total of fifty squadrons of twelve airplanes each. There is a strong prevailing tendency to furnish the greatest possible number of ships with airplanes; each of the three new cruisers of the *Primauguet* class is to be provided with six airplanes. The French fleet does not possess any airplane carriers and there seems to be considerable hesitation as to the best way of completing the construction of the future airplane carrier *Bearn*. These deficiencies are apparently to be supplied by establishing airplanes on all naval ships down to torpedo boats and dispatch boats. This plan will undoubtedly work satisfactorily in view of the special functions for which the airplanes are designed. (Submarines with swarms of airplanes will speak the last word in the Mediterranean, which will be crossed by French airplanes as a matter of course.) The French plans are favored by the existing geographical conditions, strong air stations being available or under construction at Biserta, Algiers, Oran, and Toulon and in the island of Corsica.

The following is a résumé of the French viewpoint on the functions of the French Navy and air forces in the Mediterranean:

"Air stations are much more needed at the present moment than the obsolete naval squadron. [The French chief commander is a strong advocate of the airplane as a weapon of war and favors the cooperation of great numbers of airplanes in all naval maneuvers.] The extensive field of action and future possibilities of the airplane justify the opinion that future naval battles in the Mediter-

ranean will not be decided by artillery. Victory will be achieved by the one of the two opponents who has the most powerful air force at his command. The naval battles of the future will be preceded by battles in the air, and it is possible that battleships will have nothing more to do after heavy bombing airplanes have been at work. It is indispensable that the new cruisers should be furnished with more powerful airplanes."

Experiments were made last year with the Farman super *Goliath* with a view to ascertaining the limit weight of bombs which it was capable of carrying. The super *Goliath* weighs 7,000 kilograms and carries a useful load of 4,500 kilograms. The fuel supply (2,100 kilograms) furnished a 10-hour flight with an average speed of 180 kilometers. The experiments showed that this airplane could carry 5,000 kilograms of bombs to a distance of 1,000 kilometers. The smaller bombing airplanes also furnished very satisfactory performances. It may be gathered from the results of these experiments that every bombing airplane can carry a minimum bomb load of 1,500 kilograms, a medium airplane 2,500 kilograms, and a large airplane 5,000 kilograms.

Italy.—A law issued in May, 1925, establishes the following standard for the Italian air forces: (1) An independent air fleet consisting of seventy-eight echelons; (2) an army air fleet of fifty-seven echelons; (3) a naval air fleet of thirty-five echelons consisting of ten airplanes each; (4) a colonial air fleet of twelve echelons; total, 182 echelons. The personnel must be increased to 2,000 officers and 20,000 men. This plan is to be realized in the course of five years. In the summer of 1926 the air fleet will consist of ninety echelons with 900 airplanes. The thirty-five naval echelons will be furnished with seaplanes; six of them will be attached to the navy. The remaining twenty-nine are designed for coast defense.

Russia.—On the occasion of the eighth anniversary of the Soviet Government the chief of the naval air forces gave a lecture on the progress of aviation. He spoke of the great efforts which had been made and which had been crowned with appreciable success. Although Russian motor construction was still dependent upon foreign import, this dependence would soon cease owing to the extraordinary progress of Russian technique in this particular branch. Airplanes participated in last year's summer and autumn naval maneuvers. By cutting down the numerous and extremely exaggerated reports of the present condition of the Soviet air fleet, we can extract the following data relating to the middle of last year and which are probably approximately correct: 987 airplanes (including seaplanes) were in commission, of which 625 were observers, 296 fighting airplanes and 66 bombers. They are organized into echelons of twelve airplanes each, four of which are

reckoned to the reserve. According to this schedule, the air fleet consists of ninety-eight echelons, but few of these are actually filled up and the whole plan is not much more than a framework. The majority of airplanes are distributed over European Russia. The names of 1,214 flyers are entered upon the official lists, of which 784 are pilots and 430 observers. The Baltic Sea fleet has been furnished with eighteen echelons, which, however, only include sixty airplanes and are therefore also nothing but a framework. The Black Sea fleet has 100 airplanes of which sixty-five are said to be quite up to date.

Expansion of Air Mail Service Will Promote Development of Commercial Aviation with Passenger and Freight Facilities

The Daniel Guggenheim Fund for the Promotion of Aëronautics has summarized from government and other statistics the material published herewith in regard to the air mail service in the United States. In view of the fact that the government is gradually withdrawing from participation in the actual carriage of mails through the air, public support and use of the air mails will be necessary in order that private commercial companies may and will continue to carry the mails on contract. Today privately operated routes have double the mileage of the government route.

The Daniel Guggenheim Fund has no interest, financial or otherwise, in any of the private companies which have contracted to carry the mails for the government, or, for that matter, in any commercial enterprise. However, the members of the fund realize that *use of the air mail service in this country will not only be beneficial to business by greatly speeding up the distribution and delivery of important mail, but will promote the development of the airplane industry in America and will aid the United States to maintain leadership in this form of transportaton.*

Harry F. Guggenheim, *President.*

Editor's Note: The members of the Daniel Guggenheim Fund for the Promotion of Aëronautics are:

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W. F. Durand	Elihu Root, Jr.
George W. Goethals	John D. Ryan
Harry F. Guggenheim	Orville Wright

Since its inauguration on a permanent basis in 1919, the air mail service of the Post Office Department has steadily increased its facilities until now twenty-nine states and the District of Columbia are traversed by air mail planes. Three new routes now under advertisement will add two more states to the service. The mileage flown with the mails has increased 45 per cent since 1921 and

will be much larger this year because of the new routes established under government supervision but operated by private contractors.

A high percentage of performance has been maintained, although the government operated route, which is the only one operating for a time sufficient to warrant comparisons, involves night flying over dangerous mountains. Only two fatalities occurred last year on this route, or one for each 1,128,000 miles flown.

Expansion of commercial aviation in the United States will be one result of private operation of air mail routes. It is the policy of the government to turn over this business to private capital as soon as reliable firms can be found to operate the lines. However, as Postmaster General Harry S. New has pointed out, there is no profit in carrying the mails alone and consequently for private operation to be successful the mails must be supplemented by traffic in passengers and freight and express.

The government's participation, according to official sources, has had for its mission the encouragement of commercial aviation by the operation of the postal air service and by demonstrating the efficiency of American flyers and American aircraft.

Private Airplane Operators Made 258,762 Flights in 1925

During 1925, as reported to the Aëronautical Chamber of Commerce, 290 airplane operators made 258,762 flights for a total of 5,396,672 miles. These operators were located in forty-one states and possessed 676 aircraft, carrying 205,094 passengers and 112 tons of freight and mail. Twenty-nine planes were used in crop dusting and ninety-two operators were equipped for aerial photography. Flying schools were maintained by ninety-four operators.

First Route Opened in 1918

The first air mail route in the United States was opened on May 15, 1918, between Washington and New York in cooperation with the War Department which furnished the planes, pilots, and maintenance. The service was transferred to the control of the Post Office Department in August and was operated until 1921 when it was discontinued. The first leg of the transcontinental route was opened in 1919 and the final leg a little more than a year later. Through daily schedules, involving night flying, were begun July 1, 1924, while the New York-Chicago night air mail was initiated a year later.

The transcontinental route from New York to San Francisco, involving air transportation between Hadley Field, New Brunswick, New Jersey, and San Francisco, 2,669 miles, is government-operated. The Post Office Department, however, has awarded contracts on thirteen supplemental routes to private operators,

eleven of which, with a mileage of 3,912, are now in operation. The two routes not in operation total 1,241 miles. The first service on contract routes under private operation was begun February 15, 1926.

Two Routes for Foreign Mails Operated

Under private contract also are two foreign mail routes: one from Seattle to Victoria, British Columbia, connecting with outgoing and incoming trans-Pacific mails, and the other from New Orleans to Pilottown, Louisiana, connecting with mail steamers to and from Cuba and South and Central America. At the present time three additional contract routes are being considered, one from Cleveland through Akron, Dayton, Columbus, and Cincinnati to Louisville; another from Detroit to Grand Rapids; and the third from Philadelphia to Norfolk, via Washington. Express and passengers are now being carried on the Grand Rapids-Detroit route, while mail and passengers are being carried on the Philadelphia-Washington route and passengers on the Philadelphia-Norfolk line.

Since its inauguration, planes of the government-operated air mail service up to June 30, 1926, had traveled 11,264,532 miles with mails and 1,809,992 miles in ferry and test flights for a total of 13,074,524 miles. During this time there were thirty-one fatalities, or one for every 421,759 miles flown. During the last fiscal year there were two fatalities for the 2,256,000 miles flown with mails, or one for each 1,128,000 miles. Sixty-one minor injuries were suffered by air mail employes last year, or one injury for 36,983 miles flown.

High Percentage of Performance

The percentage of performance for scheduled flights of the government-operated mail planes during the past fiscal year was .9381 compared with .96 for the previous year. The following table shows operations by years since 1921:

Fiscal Year	*Miles Flown With Mails*	*Letters Carried*	*Appropriation*
1921	1,555,000	44,834,000	$2,654,000
1922	1,538,000	48,989,000	1,418,000
1923	1,591,000	67,876,000	1,897,000
1924	1,523,000	60,001,000	1,499,000
1925	2,077,000	9,301,000	2,744,000
1926	2,256,000	14,145,000	2,810,000

In the early stages of the air mail the planes were filled with letters posted at ordinary rates, which accounts for the large number of letters carried from 1921 to 1924 and for the huge decrease

the two following years when only letters at full air postal rates were carried.

Aëronautical Clubs

The Daniel Guggenheim Fund for the Promotion of Aëronautics, Inc., wishes to maintain a full list of all flying clubs. Secretaries of such clubs are requested to forward their names and addresses to the Daniel Guggenheim Fund at 598 Madison Avenue, New York City.

Safety Is Primary Necessity

Naturally, service on the government and private routes will be improved with the development of the science of aviation. The most important step in the progress of aviation is undoubtedly that of securing safety in flying. It is believed that if a fair factor of safety is established, other measures of progress will follow as a matter of course. It is because of this conclusion that the Daniel Guggenheim Fund for the Promotion of Aëronautics will devote its primary energies toward securing this element of safety. Safety is being stressed more and more as the most important means of enlisting popular support in aviation. The national airways, for instance, which are maintained by the Army Air Service and which extend, roughly speaking, from New York west to Kansas City and south to San Antonio, have been traversed during the four years of their establishment by planes traveling a total of 1,200,000 miles, or forty-eight times around the earth. During these four years there has been but one serious accident.

An impressive record has also been made by Torpedo and Bombing Plane Squadron No. 1 of the Scouting Fleet Aircraft Squadrons, United States Navy. The twelve planes of this squadron, which was organized last fall, have flown 216,000 miles, or equivalent to eight and a half times around the world, without a single serious accident.

The primary cause of the slow development in commercial aviation has been the lack of popular support occasioned by the absence of safety. As a greater degree of safety is assured, the public will give its financial support to aviation. As an example of this, last year the companies now composing the Luft Hansa, a merger of fifty air lines in Germany, carried 133,639 passengers and 2,240,586 pounds of mail, freight and baggage for a total of 4,679,083 miles with only two fatalities.

Numerous Factors in Airway Maintenance

Air transportation demands many things that the layman never thinks of. The airways must be mapped and equipped with emergency landing fields and navigational aids. Since weather condi-

tions play a most important part in flying, the pilot must have accurate meterological data supplied by radio. For night flying the airways must be illuminated and the airports must have sufficient lighting apparatus to permit safe landings. Consequently, scheduled air flying is dependent on installation of this equipment by the government, which is the only agency with sufficient capital to bear the burden of such development.

Congress accordingly approved the Air Commerce Act in May, authorizing the Secretary of Commerce to encourage and control commercial flying, provide navigational facilities, formulate regulations which will make for safety in flying and investigate and make public the causes of accidents in commercial air navigation in the United States. The Secretary will issue regulations relative to the registration of planes and to their airworthiness, will examine and classify airmen and will establish rules for navigation, protection and identification of aircraft.

U. S. Will Establish Air Routes

This same government agency will designate and establish commercial airways and establish and maintain along these airways such navigational facilities as are necessary, with the exception of airports, which, with terminal landing fields, the municipalities are to be encouraged to maintain.

Among the navigational aids will be weather reports, forecasts and warning, radio directional finding facilities, airway marking and lighting and maps. The act authorized the appointment of an Assistant Secretary of Commerce for Air, who will supervise the development of commercial aviation just as the recently appointed Assistant Secretary of War for Air and Assistant Secretary of the Navy for Air will direct aviation in their respective departments.

Airways and Fields Lighted

Under the direction of William P. MacCracken, Jr., the assistant secretary of aviation, the Commerce Department already has authorized purchase of ninety revolving lights which will be erected on seven airways. These lights will have a visibility of fifty miles during favorable weather and under ordinary conditions a pilot will be able to see three or four of the lights when in flight.

The lights will be placed at intervals of ten miles along the whole length of the New York-Boston route and along the St. Louis-Chicago route and such portions of other routes as are flown after dark during the winter months in performing the present air mail schedules. Steps will also be taken to provide lighting for the boundaries of all emergency landing fields, which are located

about every thirty miles along established airways. All the routes selected for beacon lights are at present being flown by companies with mail contracts. Some of these companies, among them the Western Air Express, the Florida Airways and the Philadelphia Rapid Transit line, already are carrying freight and passengers in addition to the mails.

Planes Overhauled Frequently

Eighteen regular landing fields and more than ninety emergency fields are maintained by the government on the transcontinental air mail route. The route is divided into four divisions—New York-Chicago, Chicago-Cheyenne, Cheyenne-Salt Lake City and Salt Lake City-San Francisco.

There are 572 employes, including pilots, in the postal air service, whose annual salaries amount to $1,080,400, or an average of $1,889. The service has seventy-six planes, of which seventy-three are in good condition and three are being reconditioned. Sixty-one planes are equipped for night flying. The department has ordered fifty-one new planes, which are now being delivered.

The department maintains shops in Maywood, Illinois, where all repair work is done, motors overhauled and supplies stored. After 100 hours of service motors are taken from all the planes for overhauling, while after 750 hours of flying all planes are taken to Maywood for reconditioning. Each pilot is assigned a plane for his exclusive use, but reserve planes are stored at all stations along the route where hangar space is available.

Radio Directs Mail Pilots

For night flying planes are equipped with running lights similar to those carried by ships at sea, a red light on the left wing, green light on right wing and white light on the tail. High power landing lights are carried on each wing, the candle-power being approximately 150,000. The instruments are painted with luminous paint and the board and compass have small electric lights. In addition, each plane carries for emergency use two parachute flares, each of which gives a 30,000 candlepower light for four minutes.

Powerful radio transmitting and receiving sets are located at all the regular or terminal fields except Des Moines, Iowa, and Rawlins, Wyoming. All the regular or terminal fields except Des Moines have hangars and well equipped shops. Des Moines has only a small shop and office. Each emergency field has a beacon tower fifty-three feet in height and a small office.

Of the 2,669 miles in the transcontinental route, the 2,045 miles between New York and Salt Lake City are lighted by 520 gas or

electric lights, some of which are automatic. Installation of the lighted airway cost $542,108, and the annual maintenance costs about $300,000, half of which is in wages for the caretakers. The value of all property owned by the air mail service is approximately $3,500,000.

MISCELLANEOUS

The Pacific Zone Today

Naval and Military Record, 29 September.—It has become a habit of thought with those who seek the most probable zone of the next naval conflict to turn to the Pacific. This does not mean that they regard another naval conflict as inevitable. But if one comes at all they consider it more likely to break out in the Pacific than in any other part of the world. The reasons for this conclusion lie pretty near the surface. What are called the aspirations of Japan, which might much more properly be termed the needs of Japan, are the chief of them. The rivalry of American naval policy with Japanese naval policy is another. This rivalry, it has always seemed to me, is rather one-sided. America is determined that Japan shall not establish the hegemony of the Pacific, because she regards this as a potential menace to her Pacific possessions and even to her Western seaboard. So she has based the bulk of her fleet in the Pacific. But this is rather taking an assumption for granted. In saying this I am not criticizing American policy. She has to put her big fleet somewhere, and the Pacific certainly appears the proper strategical cruising ground for it. But by so doing she has created the "Pacific zone," not Japan.

The recent statement by the government of Japan upon its emigration policy is a pronouncement that must react upon the naval outlook. In effect Japan says, in a very dignified way, that since various countries have barred the door of admission to her people she will not contest the point, but will seek a solution of the problem created by her urgent necessity for expansion within the territories already in her own possession. How far Formosa and Korea will afford scope for this plan I am unable to say. In this respect we can only wait upon time. But what really matters is the very pacific purport of such a declaration. One of the surest causes of war is the attempt to curb the expansion of a country in the shape of closing outlets for its surplus population. We have always regarded the Japanese Navy as dedicated to the purpose of enabling the Japanese nation to expand when and where they may think occasion opportune. The new policy of the Japanese Government disposes of this idea. Personally, I have never had any doubt in my own mind that the ultimate objective of Japan is Manchuria. This rich province would yield her all the necessaries for industrial expansion which her own soil lacks. It would

give her plenty of elbow room for her overflowing population. Nor do I believe that this country would be particularly antagonistic to the idea so long as she is assured of equal trading rights. We talk about the undesirability of the partition of China, but China is now in such a state that whatever may happen cannot be much worse than the present case. On the other hand, there is very definite reason to believe that the United States would be hostile to the idea. Russia certainly would. I do not think it an extreme view to say that either country might make the attempted annexation of Manchuria by Japan a *casus belli*.

Does the new emigration policy of the Japanese Government remove all prospect of future trouble in regard to Manchuria, I very much question it. No doubt it will postpone it. But the quiet, unobstrusive, "peaceful penetration" will continue. It would be ridiculous to imagine otherwise. Japan needs many things which she can get in Manchuria more easily than elsewhere. And so she goes on making treaties based upon the principle of getting these things on the most advantageous terms. Such treaties inevitably have a diplomatic significance. The Japanese are a great military nation, but they do not want to go to war if they can possibly attain their end without. They are prepared to wait, and meanwhile to go steadily on their set course. The real danger will arise when some other great power thinks it time to call a halt to this course.

Japan is in a unique strategical position for waging a war upon her own terms—that is to say, either in Eastern waters or in Manchuria. The suggestion that the great Singapore base is really aimed at Japan is ridiculous. Look at the map, measure off the distance from Singapore to Yokohama, and ask yourself whether the place is a suitable base for battleship operations against the Japanese? The real truth is that we do not contemplate a war with Japan as a possibility of the future. But we do contemplate the possibility of war between Japan and some other great power or powers. In such an event it would be very desirable for us to possess a first-class base upon which to assemble adequate forces for the protection of our own immense interests in the Far East. This, I believe, is the real *raison d'être* of the Singapore scheme.

The recent declaration by the Japanese Government at any rate removes—or indefinitely postpones—one of the most disturbing factors in connection with the maintenance of peace in the Pacific. Australia has always been frankly apprehensive of the "Yellow Peril"; of an incursion into her wide spaces of vast hordes who are literally pushed out by over-population at home. Hence the fact that Australia bears a vastly larger proportionate share in the cost of maintaining Imperial sea power than any other of the Dominions. To Australia this recent reassurance—an assurance, I

repeat, worthy the dignity of a great, proud nation—means infinitely more than it can to any other country. To ourselves it has a direct importance in this same sense, since the question figures in the very forefront of Imperial naval politics.

How the United States will view this "gesture" is not for me to speculate upon. We must wait and see—which is probably just what the United States will do. But one thing is certain. The horizon of the Pacific zone is clearer of clouds than it has been since the end of the Great War. China, of course, may yet have to be dealt with by international action, but, barring the probable attempt of Russia to make trouble in such an event, this is a contingency we may view with equanimity. It is a great pity that there have been such open manifestations of distrust of Japan's policy in China in the past. The consequence is that, at a juncture when she could take a very active hand to great advantage, she metaphorically folds her arms and says "pull your own chestnuts out of the fire!" It certainly cannot be said of her that she is trying to exploit opportunity to her own advantage. With the third most powerful navy in the world within a few days' steaming distance of Hankow, she could have taken up the daggers to pretty effective purpose during the recent crisis. And so, it seems to me, the students of naval strategy, who must always visualize a "zone," will have to seek elsewhere, and substitute a new phrase for "oceanic warfare." The Mediterranean may well become a much more "live spot" than the Pacific. France is thoroughly annoyed with Turkey, and Italy is annoyed with France. I do not know that Spain is annoyed with anybody in particular, but she is certainly strengthening her fleet and getting it into highly organized order. The Baltic may hold possibilities in the not very remote future. Germany does not mean to suffer the existence of the Danzig corridor indefinitely, and Poland knows it, hence she is builiding up her new sea power as rapidly as she can afford, with France encouraging her. Russia may be trusted to exploit any prospect of trouble, and possibly take an active part in things should it come to blows. None of these matters directly concern us. The Pacific zone does. Hence the prospect that it will continue true to its peaceful name is a cause for congratulation.

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NOTES ON INTERNATIONAL AFFAIRS

FROM 3 OCTOBER TO 3 NOVEMBER

PREPARED BY

PROFESSOR ALLAN WESTCOTT, U. S. NAVAL ACADEMY

GREAT BRITAIN

NATIONHOOD FOR BRITISH DOMINIONS.—It was reported that at the Imperial Conference in session in London at the close of October, a plan was being worked out for changing the status of the dominions to practically independent nations. The governors general would become viceroys, i. e., representatives of the crown rather than the home government; dominion high commisioners in London would become ministers; and dominion representatives in other countries, as for example the Canadian and Irish representatives in Washington, would have full ministerial status.

The Imperial Conference of premiers from the British Commonwealths opened in London on October 19 and after two weeks was still in session. It was the eleventh meeting of this general character since the first "Colonial Conference" in 1887. The name was altered to "Imperial Conference" in 1911 and the presiding officer became the English Premier rather than the Colonial Secretary, these changes typifying the increased importance of the dominions. With this growth have developed centrifugal tendencies, which it is one of the purposes of the conferences to overcome.

Thus, in the present conference, Premier Herzog of South Africa was decidedly less interested in aid to the mother country than in a clearer definition of the status of the various "commonwealths" in their relations with each other, and the reported elevation of the dominions to full national status was evidently with this purpose in view. On the other hand, Premier Bruce of Australia declared that "if any man is going to suggest that we shall now take some action which might lead to the disintegration of the empire, then for Australia I say we are going to have nothing to do with it." And Premier Mackenzie King of Canada scouted talk of Canada's joining the United States as merely party politics.

Behind closed doors on the second day the conference listened to an extended review by Foreign Secretary Chamberlain of British foreign affairs since the last conference in 1923, and a defense of the Locarno treaties as not committing the empire to

dangerous participation in European affairs. The Australian, New Zealand, and South African premiers all expressed the eagerness of their respective countries to retain the various mandate territories which they have held since the war. On October 28 the conference was especially interested in an outline by the British Air Secretary of plans for intensive development of air communications on an imperial scale, to serve like the navy and merchant fleets as a means of linking the empire. Premier Mackenzie King pledged cooperation in preparations for experimental flights to Canada via Ireland and New Foundland, or possibly to Northwest Canada via the polar seas.

DOMINIONS AND NAVAL COSTS.—Great Britain's vital need of assistance from the dominions is brought out clearly in an article on "Imperial Conferences and Imperial Defense," published in the Canadian *Defense Quarterly* for October. The article ends with the following statistics and comment, emphasizing Canada's tiny naval contributions in proportion to her population and sea-borne trade:

Country	Expenditure per head of population on naval defense	Total value of sea-borne trade in millions of dollars	Amount spent on naval defense for every $10,000 of sea-borne trade
Great Britain.	$6.44	$10,925	$269.00
Australia	$3.00 increasing to $4.25	$ 1,533	$124.00
New Zealand.	$2.00 increasing to $2.50	$ 522	$ 50.00
South Africa (White Population)	0.42c	$ 717	$ 9.00
Canada	0.15c	$ 933*	$ 15.00

*Canada's imports and exports are double this figure; the balance is accounted for by trade with the United States, which is not sea-borne.

In the comparison, too, it must be borne in mind that Australia, New Zealand, and South Africa have continuous coast lines, whereas Canada has a Pacific and Atlantic coast line with no means of quick transfer of ships from one coast to the other (especially if the Panama Canal were to be closed to Canada on the outbreak of war), so that Canada is forced to divide her forces between the two coasts.

Such is the present position. What of the future? Are the disastrous consequences that would have followed the severing of the empire's sea communications in 1914, fully realized?

In Great Britain, trade is diminished, unemployment is high, taxation is grievous. The mother country cannot bear the burden unaided.

The call for economy is great and the need urgent. But even more urgent, and indeed vital, is the call for safety of the empire's trade. Urgent too is the need for maintenance of the international prestige of the empire as a whole, and of each component part of the empire, for this empire is today the greatest factor in the world making for the progress of international peace and world progress.

We cannot, we dare not, forget that it is on the navy, under the good Providence of God, that the wealth, safety, and strength of the empire chiefly depend.

Asquith Resigns as Liberal Leader.—On October 14 Lord Oxford and Asquith announced the end of his leadership of the Liberal Party in the United Kingdom. His resignation was due in part to age, for he is now seventy-five, but primarily to the opposition of former premier Lloyd George. Mr. Lloyd George's conciliatory references to Lord Oxford and his followers, in a speech soon afterward, were interpreted as a bid for succession to leadership.

INTERNATIONAL ECONOMIC DEVELOPMENTS

British Continue Rubber Control.—On November 1 the British Colonial Office announced that, in continuance of the Stevenson plan for restriction of rubber exports from Ceylon and Malaya, the exports for the ensuing quarter would be cut from 100 to 80 per cent. This was because the average price for the current quarter was below twenty-one pence. In following quarters the plan provides for the reduction of output as low as 60 per cent, or increase to 100 per cent, according as prices fall below twenty-one pence or rise above twenty-four pence a pound.

On the same date the U. S. Department of Commerce stated that government control now affects nine important commodities of which the United States is a purchaser—rubber, coffee, long staple cotton, camphor, iodine, nitrate, potash, mercury, and sizal. This, together with the current talk of international control of prices and output of steel and sugar, must be considered as a new and significant development in world economics.

Anglo-German Industrial Conference.—A notable conference, the first of its kind and scope, was held between British and German industrial and financial leaders during the week ending October 11 on the estate of Colonel William Ashley, British Minister of Transport, near London. Although no definite agree-

ments were made public, there were suggestions of cessation of rivalry in ship building, and of accords in steel, iron, and coal. The meeting was regarded as a tentative step on the part of Great Britain toward entry into the Continental economic union including France, Germany, and Belgium, now in process of formation. Either England must take this step, or else, continuing her policy of isolation, hope by closer trade cooperation within the empire to meet both Continental and American competition.

APPEAL FOR LOWERING OF TRADE BARRIERS.—One document, at least associated with the Anglo-German Conference, was an extraordinary appeal, signed by an imposing array of over 100 leading international financiers and industrialists, issued in London on October 19, and entitled "A Plea for the Removal of Restrictions on European Trade." The plea called for the breaking down of customs barriers and similar obstacles hindering the free flow of trade across European frontiers. Among the American signers were J. P. Morgan, Thos. N. Perkins, and several presidents of banks and trust companies. The document read in part as follows:

"We desire, as business men, to draw attention to certain grave and disquieting conditions which, in our judgment, are retarding the return to prosperity. . . . .

"The break-up of great political units in Europe dealt a heavy blow to international trade. Across large areas, in which the inhabitants had been allowed to exchange their products freely, a number of new frontiers were erected and jealously guarded by customs barriers. Old markets disappeared. Racial animosities were permitted to divide communities whose interests were inseparably connected. . . . .

"Too many states, in pursuit of false ideals of national interest, have imperiled their own welfare and lost sight of the common interests of the world by basing their commercial relations on the economic folly which treats all trading as a form of war.

"There can be no recovery in Europe till politicians in all territories, old and new, realize that trade is not war but a process of exchange, that in time of peace our neighbors are our customers, and that their prosperity is a condition of our own well-being. If we check their dealings, their power to pay their debts diminishes and their power to purchase our goods is reduced. Restricted imports involve restricted exports, and no nation can afford to lose its export trade. . . . .

"We wish to place on record our conviction that the establishment of economic freedom is the best hope of restoring the commerce and the credit of the world."

AMERICAN COMMENT.—On October 24, soon after the appearance of the Trade Barrier Appeal of October 19, Secretary of the

Treasury Mellon issued a statement to the effect that the manifesto evidently referred solely to Europe, and had no application to the United States tariff. He argued that reduction of our tariff would lower our living standards by driving industries abroad where labor is cheaper.

A statement from the White House pointed out that it was very natural to find international financiers advocating measures that would help nations in economic difficulties, and that those who lend money internationally always favor free trade.

WORK OF DISARMAMENT COMMISSION

Sub-Committee on Economic Phases.—A sub-committee of thirteen experts, to which the Preparatory Commission for the proposed disarmament conference had referred economic phases of disarmament, met in Paris for a ten-day session October 18-28. The report of the committee, largely technical in character and designed merely to clear the way for the work of the Preparatory Commission, reached no very definite conclusions. It expressed the opinion that disarmament by proportional scaling down of military budgets of various nations would be impractical, and that results could better be secured by separate agreements for armament reduction between nations. The question of the weight to be attached to the economic development of nations, in measuring their military resources, was left practically untouched.

The committee recommended the ultimate creation of a permanent international arms surveillance body, which should be charged with the collection of armament statistics and with enforcement of whatever limitation program the future conference might agree upon.

Italy Shifts on Naval Reductions.—Italy, which hitherto had stood firmly with France for reduction of naval armaments only by total tonnage and not by classes of vessels, surprised the conference on October 20 by declaring that "while she had always maintained that limitation by total tonnage was the most equitable method for smaller navies, a method of limitation by classes might be equitable for larger navies, and the two methods might be used together." A Spanish delegate at once supported this declaration, and the concession appeared to cheer the commission, which after five months' work had made little or no progress. Italy's shift was unexpected, since, like France, she had favored reduction by total tonnage as a means of retaining the privilege of putting most of her naval allotment into submarines and small units.

On the same date France and six other European states reiterated their former decision that they would be unwilling to

limit their number of trained reserves until a system of security was organized that would compensate for their inequality in war resources. Reduction of reserves, a French delegate declared, would sacrifice nine-tenths of the defensive power of one of France's most important arms. Here again, as in the naval discussions, it appeared that the efforts of five months had reached nowhere.

FRANCE AND BELGIUM

BELGIAN FRANC STABILIZED.—The Belgian Government on October 25 announced stabilization of the Belgian franc at 174.30 to the pound and 36 to the dollar. A new monetary unit (not a coin) called the belga was created, to be used only in foreign transactions, amounting to five francs and valued at 35 to the pound and 7.20 to the dollar.

FRENCH PLANS FOR DEBT PACT RATIFICATION.—Prior to the opening of the French parliament in November, Premier Poincaré announced that he hoped to get the Franco-American Debt Agreement ratified by the Chamber by writing in a series of "provisos" that would not have the effect of reservations but would register the French misgivings about the agreement as it stands. The agreement would not be brought up in the Chamber, however, until after consideration of the budget, which would no doubt postpone it until the new year.

In the meantime, the rise of the franc, with the easing of French finances under Poincaré, has had the curious yet not unnatural effect of making French politicians less willing to accept the bitter dose of the debt agreement, and has also permitted a revival of party warfare which threatens the early fall of the ministry itself.

GERMANY

SETTLEMENT OF HOHENZOLLERN CLAIMS.—The Prussian Diet by a vote of 258 to 37 ratified on October 15 the financial settlement between Prussia and the Hohenzollern family, thus carrying out the decision of the popular referendum on the question last June. Sixty-five socialists abstained from voting, but only the communists opposed. The bill transferred to the ex-kaiser 15,000,000 marks ($3,570,000) in settlement of all claims.

RESIGNATION OF GERMAN ARMY HEAD.—General von Secht, able head of the army of the German Republic since 1920, was forced to resign in October, owing to agitation aroused by his allowing the former Crown Prince to take part in recent army maneuvers without regular enlistment. Lieutenant General Wilhelm Heye succeeded with diminished powers.

ITALY

Mussolini's Life Again Threatened.—Benito Mussolini escaped the sixth attempt on his life when on October 31 he was shot at by a 15 year-old boy, as he was leaving a scientific meeting at Bologna. The bullet tore decorations on the breast of the Premier's coat. The boy was beaten and stabbed to death by the mob.

Italian Expansion.—In a speech at Perugia early in October Premier Mussolini took occasion to recall the ancient days of Roman sea power, when at first the Romans "could not even wash their hands in the Mediterranean without permission of the Carthaginians," and when later, after the Punic Wars, the Mediterranean became a Roman lake.

Both in Italy and abroad the speech prompted comment on Italy's ambitions for over-seas expansion, in view of her increasing population and need of markets. The *Journal de Genevois*, usually well informed in League of Nations affairs, reported on October 21 that a subsequent conference between Premiers Mussolini and Briand would have as it chief subject the transfer of the French mandate of Syria to Italy, in return for renunciation of Italian ambitions in Morocco and Tunis. The London *Daily Express* in the same week featured an alleged revelation to the effect that Premier Mussolini had definite plans for seizure from Turkey of the Adalian strip on the south coast of Asia Minor, with the connivance if not the armed support of Greece.

In the *Fortnightly Review* for October, "Augur" discussed England's attitude toward these naval and colonial aims of Italy in the Mediterranean. "People speak," to quote the article, "of the menace of an Italian naval base at Neros in the Ægean, but if the Italian naval armament is any good its central position between Sicily, Sardinia, and Tripoli constitutes a more serious menace," He argues that England may well abstain from interference with Italy's plans. A part of the article follows:

"Italy at present has one national problem overshadowing all others to such an extent that it really is the 'only' problem. This is her surplus of population, for which today there is no good outlet. The need of solving this problem is so pressing that there can be no suggestion of Mussolini discussing it when he wants, and shelving it when it so suits him. He must concentrate, willy-nilly, on the all-important issue. It is certain that he has given serious thought to the matter. When whole continents are closed against the Italian emigrant, and when there is danger of the few meager outlets yet open being intercepted, as for example in France, Mussolini cannot hesitate and must look round to find the empty land towards which immigration may be directed in a broad

stream. It is clear that it is not in Tangier or in Abyssinia that the promised land can be found. Morocco, Egypt, Tunis, and Syria are under the hand of the two great powers with which Mussolini is not ready to try conclusions. Agrarian concessions in Soviet Russia have been considered and set aside as impracticable. Unavoidably the eyes of the Italians turn to the empty spaces in Asia Minor, where an uncultured government continues its efforts to change a fertile land into a wilderness. Official loyalty towards Turkey may prevent the formation of an openly avowed plan, and fear of other powers may prove an obstacle, yet a populous and civilized nation is drawn with irresistible force to look towards a sparsely inhabited and weakly held land. The thing cannot be prevented. And there is the idea that ways may be devised to satisfy the land hunger without having recourse to violence. The Turks at Angora instinctively feel the pressure of the Italian eye turned towards them. This fear has helped them to make up their minds to sign the Treaty of Mosul with Great Britain. The same fear drives them to seek additional security in the membership of the League of Nations.

"Mussolini has weighed the facts and seems to have arrived at a decision. There is reason to believe that his first step will be to have recourse to the League of Nations. He will ask his fellow-members to consider the conditions in overcrowded Italy, and he will ask for an international effort to solve the problem. The League will be expected to declare its views on the principle involved and to devise practical means of assistance. This appeal to the League will come at the opportune moment. The latter is not yet, because, thanks to Mussolini's statesmanship, Italy is stemming the tide of unemployment caused by an industrial crisis. But, when the expected economic stringency arises in France, thousands of Italians will be thrown back into their own country; there will be difficulty in absorbing them, and Mussolini will then go before the League of Nations.

"The League will have to consider carefully its decision. If through lack of courage the issue is shelved, Mussolini will return to a purely national plane of action, while morally his position will be strong. He will be able to treat the question of the surplus of population as one concerning Italy alone, and the powers, which as members of the League had refused to discuss the issue, will be politely asked to stand neutral while Mussolini takes appropriate action backed by all the energy which is now being accumulated in the nation. Political observers insist that this forecast should not be dismissed with a wave of the hand. For timely discussion and an intelligent understanding of the legitimate needs of the Italian nation may help to avoid serious complications in a future not too far removed."

BALKAN STATES

Hungary's Sea Outlet.—Early in October Foreign Minister Ninchitch of Jugoslavia, in an announcement to the Belgrade press, expressed recognition of Hungary's need of a sea outlet and stated that Jugoslavia had offered Hungary a free port in one of Jugoslavia's Adriatic harbors. The matter at that time had not passed beyond preliminary conversations. It appeared that, while Spalato had been offered, the negotiations would deal rather with Susak, the Jugoslav part of the port of Fiume, where large concessions would be offered for Hungarian trade. This more northerly port was preferred by Hungary as nearer and more accessible by pre-war rail systems. Present traffic from Hungary through the Italian ports of Trieste and Fiume runs to 20,000 cars yearly.

The offer to Hungary came at a time when Jugoslavia was herself very uncertain that her agreement with Greece over concessions in Saloniki would be ratified. This was negotiated by the former Greek dictator Pangalos, now under trial for treason on that very ground. It would appear that by overtures to Hungary Jugoslavia wished to assure relations on her northern frontier in the face of possible difficulties with Greece.

POLAND

Poland Objects to Soviet-Lithuanian Treaty.—The treaty of neutrality between Soviet Russia and Lithuania, signed early in October, together with similar treaties which the Soviet Government is negotiating with Finland, Esthonia, and Latvia, apparently has the effect of isolating Poland among the Baltic states.

To one clause of the Soviet-Lithuanian Treaty in particular the Polish Government raised objection in a mild protest to Moscow on October 11, on the ground that it recognized Lithuanian claims to Vilna in spite of its award to Poland by the Council of Ambassadors in 1923. This award Lithuania has never accepted. The Polish note to the Soviet Government declared that the latter by its agreement with Lithuania violated the Soviet-Polish Treaty of Riga, in which Russia promised neutrality in event of a Polish-Lithuanian contest. Poland expressed willingness to enter into a northern "Locarno pact," but only one which should include all the northern nations.

Pilsudski Becomes Premier.—Following a confused period in Polish politics, during which the Sejm (Parliament) refused to vote the government budget and forced the resignation of the Bartel Cabinet, Marshal Pilsudski himself assumed on October 7 the office of Premier as well as War Minister. His new cabinet was hailed as a "strong left democratic government," the most stable since Poland's independence in 1918.

ROYAL LEANINGS OF PILSUDSKI.—Fears of socialists, and hopes apparently of most of the rest of Poland, that Marshal Pilsudski had finally decided to accept kingship, were aroused on October 25 when the Marshal attended a great banquet of powerful landowners and avowed monarchists on the estate of Prince Radziwill. He returned without the crown, but many believed that his assumption of royalty awaited only the dissolution of the present parliament.

SOVIET RUSSIA

STALIN OVERCOMES OPPOSITION.—The opposition within the communist party headed by Trotsky, Zinovieff, Kameneff, and others, was forced in the middle of October to tender what amounted to an unconditional surrender to the central executive committee controlled by Stalin as leader of the majority group of the party. The opposition admitted its conduct was calculated to split the party, confessed violation of discipline, and promised to dissolve its organization and submit without reserve to decisions of the central committee. Zinoviff, chairman of the executive committee of the the Third Internationale, and arch-exponent of world revolution, was subsequently (October 23) expelled from the committee, as no longer a representative of soviet policy. Later, on October 31, the so-called "Workers' Opposition," an organization which since 1921 had held steadfastly to "pure communism" against the New Economic Policy of Lenin, also made complete surrender to majority rule. It will be noted that the opposition leaders in these cases were more "red" or "left" than the majority.

Power in the Soviet Government is now firmly in the hands of Joseph Stalin, who is officially only Secretary General of the communist party. Among his chief henchmen are Rykov, President of the Council of People's Commisars (or Premier), and Iribeschev, who has succeeded Dzerzhensky as Chairman of the Supreme Economic Council.

The conflict among the soviets is primarily between the "pure communism" advocated by the Trotsky group, and the temporizing policy of modified capitalism now pursued by Stalin and embodied in the New Economic Policy. Briefly, Stalin and his followers seek to win peasant support by continuing their virtual ownership of the land, extending their franchise and representation, and by strictest governmental economy securing funds to expand Russian industry so as to meet peasant needs. As Mr. Walter Duranty has said, Stalin and his followers "have their ears closer to the Russian soil than have the opposition leaders, who are more closely affiliated with the international proletarian movement."

From another point of view, the Stalin group aim to keep power in Russia firmly in their own hands, whereas the minority would

extend a voice in affairs to the rank and file of the communist party. (Of course both sides aim to keep power within the communist party of about one million members).

The All-Russian Soviet Congress, which was to have met this autumn, has been postponed until spring. In it, the non-communist representation is said to have been greatly increased.

CHINA

Fall of Wuchang.—The Yang-tse city of Wuchang, long besieged by the Cantonese forces under Chang Kai-shek, surrendered on October 10. It was reported that Yang Sen, the Central Chinese commander who was responsible for the seizure of British vessels at Wanhsien, had gone over to the Cantonese and had been offered a command in their army.

During the campaign the southern army conducted itself with restraint as compared with the northern troops, and this together with a flood of propaganda through central China brought about a growing feeling in favor of the Cantonese. With Wu Pei-fu defeated, and the Manchurian leader Chang Tso-lin in financial straits, ascendency of the Cantonese in China appeared a possibility, which would mean prompt abrogation of the special rights and privileges now held by foreign nations.

Foreign Navigation Rights in China (By Thomas F. Millard in New York *Times*, October 29).—Shanghai, September 15.—The armed clash last week at Wanhsien between a British naval flotilla and troops of a Chinese general that resulted in a score of casualties on the British side and from 1,000 to 2,000 estimated casualties on the Chinese side again draws international attention to one very irritating phase of relations of foreign powers with China. This is the "right" of foreign naval and merchant ships to navigate the interior and coastal waters of this country.

That "right," like nearly all of the foreign privileges to which the new Chinese nationalism now objects, is based on old treaties obtained from China partly by intimidation and partly because Chinese officials of that time were ignorant of what they conceded.

In his book *Foreign Rights and Interests in China*, published in 1920, Professor W. W. Willoughby of Johns Hopkins University (formerly legal adviser to the Chinese Government), said:

"In most of the developed countries of the world the rights of inland navigation are reserved for citizens or subjects respectively of those countries. In China, however, by treaties beginning with that of 1858, which opened up the Yiangste River to British traders, nearly all of the inland water-ways have been made navigable for trade by foreigners."

That is not all. Partly by original treaty provision and later by gradual usurpation, a "right" of foreign warships to navigate the inland waters of China has been established. The Sino-British Treaty of 1858 had this provision: "British ships of war coming for no hostile purpose, or being engaged in the pursuit of pirates, shall be at liberty to visit all ports within the dominions of the Emperor of China."

Other nations, including the United States, took advantage of that provision to claim and assert a similar "right" under the most favored nation thesis, notwithstanding frequent protests of Chinese officials.

In 1903 the American gunboat *Villa-lobos* was sent to the upper Yiangste against the protest of a local mandarin, which eventually led to the following ruling by the Secretary of State:

"The department is inclined to the opinion that Rear Admiral Evans is right in his contention that our gun-boats may visit the inland ports of China, including those which are not treaty ports. Even if this right were not granted us by treaty, Rear Admiral Evans is unquestionably right in using it like ships of other powers are constantly doing. This department thinks, however, that Article LII of the British treaty of 1858 with China which is reproduced in Article XXXIV of the Austro-Hungarian treaty of 1869, gives full authority for his course."

That is, one foreign nation obtained a qualified privilege for its warships to visit China's inland ports back in 1858, which therefrom provided a precedent for the creation of a more extensive "right" for all nations.

I will not trace specifically the process by which that original treaty privilege has been stretched to its present interpretation, but will bring the situation quickly to where it has gotten in the last few years.

In time the foreign maritime powers adopted a set of policy of keeping gun-boats on the inland waterways of China, and ships adapted for this use were built. Their function is to "protect" foreign shipping plying on China's rivers to protect foreign residential concessions and to protect business whenever and wherever they are endangered or interfered with.

A mandarin, or later an official of the republic, or still later a military regional dictator, might at will seize or delay or otherwise interfere with Chinese shipping and commerce; but let one of them do likewise with foreign shipping or commerce (or any important power) and gunboats might be sent to the rescue. That put Chinese at a disadvantage in their own country in comparison with foreigners here.

An early reaction to this condition was a tendency of Chinese shipping and merchants to get under foreign protection somehow,

by putting Chinese ships under foreign registry or by taking foreigners into partnership. (That situation was a fruitful field for one kind of chicane working under the "protection" of some consuls.) Since foreign ships seldom were interfered with, and if so, were soon released, even Chinese preferred to ship by and travel on them. That threw to foreign shipping the cream of China's coastwise and river traffic. Naturally the foreign shipping companies (which are mostly British with nowadays a strong Japanese competition) want to hold the advantage that has accrued to them.

But in late years powerful influence have begun to pull the other way. Chinese now are intensely annoyed to witness ships flying foreign flags freely plying the rivers of China, often under escort of foreign gunboats. On the upper Yiangtse in these times it is an exception for a foreign steamship to make a voyage without being fired on, and it is a weekly occurrence for foreign gunboats to reply to such "shipping." For two or three years now that condition has aggravated steadily until it culminated in the Wanhsien fight.

The immediate occasion of this fight at Wanhsien is not very important of itself. Two British river merchant ships were detained there by an order of a military dictator, pending a claim for damages done by the ships, or by one of them, to Chinese. (I believe that the "wash" of a steamer overturned some junks and caused loss of lives). The merits of that issue also are not important. Ordinarily such cases would be adjusted in courts or by arbitration. In this instance the fact that a few British ship officers were arrested and held was made the reason for a British naval flotilla, composed of two small gunboats and an auxiliary ship, to attempt their "rescue."

We have now from different accounts of foreigners at Wanhsien a fairly good idea of what happened. One of the British gunboats was run alongside one of the detained ships, and men from the gunboat boarded the ship for the purpose, it is said, of releasing the foreign officers, who it appears, were confined in their quarters. Chinese soldiers on the ship then fired on the boarders and killed some of them. A general battle followed, in which Chinese soldiers on shore took part, and the British gunboat replied, also shelling the town and starting a conflagration which consumed a large section of it. Of the many hundreds (some accounts say thousands) of Chinese killed and wounded a large majority were non-combatants. Virtually all of the property destroyed was privately Chinese owned.

BOOKS REVIEWS

BOOK DEPARTMENT

The Institute Book Department will supply any obtainable naval, professional, or scientific book at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply of all books should be considered. The cost will not be greater and sometimes less than when obtained direct from dealers.

Address all communications to: Secretary-Treasurer, U. S. Naval Institute, Annapolis, Md.

ELEMENTARY STEAM ENGINEERING, 1926. By E. V. Lallier. D. Van Nostrand, New York. $2.50.

The present volume is a revision of a book originally published in 1913.

As indicated by the title the book is purely elementary. It is presumably designed to give a young technical student some degree of familiarity with the form and operation of power plant equipment and at the same time to supply the young operating engineer some insight into the principles upon which the operation of his equipment depends. In the mind of the reviewer it is not particularly successful in either object. Elementary text books are necessarily superficial in their treatments but by the same token they require skillful exposition and also accuracy, neither of which qualifications can be ascribed to this one.

The chapter on the "Work done by steam during formation" with that on "Engine calculations," especially the latter, is illustrative of particularly atrocious presentation of even the most elementary thermodynamics of steam and the steam engine.

A few typical inaccuracies may be quoted. It is stated that in boiler installations using pulverized coal ("coal dust") or blast furnace gas as a fuel, combustion of this fuel must be maintained by keeping a small quantity of coal burning on a grate. Also, to quote: *"Occasionally* the condensed steam in the form of water is reemployed," reference being to the use of main engine condensate as boiler feed water. Again, a suitable allowance for a shrink fit is stated to be "about one one-hundredth of an inch per inch of diameter." A steam turbine is classified as a rotary engine.

Thus it goes throughout the book. It seems particularly unfortunate that so poor a publication should be presented to the class of readers for which it is intended, a class which is necessarily incompetent to differentiate between the good and the bad.

P. J. K.

BROWN'S COMPLETED BURWOOD. New Edition Revised and Enlarged. James Brown and Son. (Glasglow) Ltd. 10/6 net.

These tables are of restricted value owing to the fact that they are only good for the sun or stars of less than 23° declination north or south and for a latitude belt north or south from 30° to 60°.

Modern developments in the art of navigation are along the lines of simplicity and the use where possible of one method and one book to cover the problem of the determination of the altitude and azimuth at the same time with no limit (except the ultimate values) as to the data used.

In tables like Aquino's for instance, practically the same solution can be used for all problems regardless of the values or the direction of measurement of the latitude, declination, and hour angle.

For vessels on the North Atlantic and North Pacific trade routes this book should be useful because the small time interval reduces the interpolation, but for general and naval use *H.O. 71* for the sun and bodies of declination below 23°, and *H.O. 120* for bodies of higher declination are much more useful on account of their general application. The example given in the explanation is out of date on account of the recent change in time.

Appendices. Appendix (A) is interesting from an academic rather than a practical standpoint.

Appendix (B). The use of the azimuth tables for the detertion of the G. C. course and distance is entirely practical and satisfactory and the description of the use of the gnomonic chart indicates a commendable desire to recognize and advocate modern methods. Other methods for the determination of the azimuth of a body of a declination greater than 23° are preferable to those indicated because they are shorter and therefore more likely to be accurate. The table for the conversion of radio bearings is useful and checks closely with other similar tables.

The other problems noted are interesting but not particularly useful.

Appendix (C). These problems and tables are of no practical value to the modern navigator who practically never has to use the amplitude of a body.

Appendix (D). This gives the approximate value within a few seconds of the declination and equation of time for a long series of years, but it should not be used if an almanac is available.

From the above it can be plainly seen that for the United States naval navigator this book contains nothing which he cannot get to better advantage from our own Hydrographic Office publications.

A. M. R. A.

GREAT CIRCLE SAILING by L. M. Berkeley. White Book and Supply Co., New York. $1.50.

Great Circle Sailing indicates that the author feels that the value of great circle sailing has not been appreciated by navigators when I am sure that a careful investigation of the charts and log books of vessels will show that the value of great circle sailing has been fully appreciated by them for a great many years, even before the end of the sailing era.

In determining the great circle courses and distances the trend of development has been towards simplification of the methods. In this matter *Great Circle Sailing* takes a step backward in the very beginning, as the value of this method is based on the correct signs of the trigonometrical functions. This dependence on signs is something that the navigation mathematicians have been trying to do away with for many years. While these signs may be used to advantage by the navigators who have had a thorough mathematical education, they are confusing even to them, due to the difference in the direction of the measurement of the trigonometrical angles and the compass angles. Consequently the seaman who has had only a limited education in this direction will always select that method in which there can be no ambiguity. The latest Naval Academy navigation textbook, *Navigation and Nautical Astronomy* avoids this difficulty by the selection of the haversine formulæ in deducing the course and distance for the great circle track. By the use of the azimuth tables for the derivation of these values still another method is available which is far more valuable than the one given in this book.

However, the only modern and thoroughly practical method of great circle sailing is the graphic method and with the gnomonic charts at present available for all large areas of the earth, there is no excuse for any other. Any desired course from one point to another may be laid down on a gnomonic chart, and the navigator can see clearly whether or not this course takes him too close to any land. The track may then be transferred by points of latitude and longitude to a mercator chart or plotting sheet, preferably the one the navigator intends to use for his other work. After these points have been laid down on the mercator chart a straight edge laid through them will indicate immediately how frequently and to what extent the course must be changed in order to keep on the great circle track.

Practical considerations, even with the modern gyro compass as a guide, make it useless to alter the course less than about 3° at a time. If a more positive type of gyro compass is perfected with an integrating dial so that a ship may be steered closer than 1°, it may be possible in the future to lay down a great circle

course which may be altered a degree at a time, but as the type of gyro compass at present in use is only guaranteed on original inspection to maintain itself within one degree on either side of the meridian, the desirability of operating on a one degree change of course is not apparent. In addition, consideration must be given to the effect of the wind, the sea, and the ocean currents, which are constantly driving the ship off the great circle track and which must be constantly allowed for, if the proper course is to be maintained.

The graphic method described above also does away with the necessity for the computation of the initial course. I cannot agree with Commander Dutton that the tangent method of sailing the great circle is the best but consider the chord method far superior. Theoretically the tangent touches the great circle at only one point so that the minute the initial tangent course is started the ship begins to go off the track. The chord method, however, particularly in an area where the tendency of the current is to set the ship further out onto the great circle is by far the best, and lends itself readily to the determination of the proper initial course by the graphic method noted above.

If the reader desires a mathematical consideration of this book he is referred to a recent article by Professor Capron of the Department of Mathematics at the U. S. Naval Academy, in the *American Mathematical Monthly*. Professor Capron has carefully analyzed the mathematical formulæ developed in *Great Circle Sailing* and shows that many of the mistakes, so called, that the author finds in other books have been due to their practical consideration of the subject, and that they are essentially more accurate than the results given in this book.

While the book is of interest from an academic standpoint it is of no value to the practical navigator.

A. M. R. A.

RHODE ISLAND PRIVATEERS IN KING GEORGE'S WAR, 1739-1748. Howard M. Chapin. Rhode Island Historical Society, Providence.

Reviewed by Captain Thomas G. Frothingham, U.S.R.

In the study of the history of the American Revolution, not enough emphasis has been given to the indisputable fact that the most successful offensive of the American Colonies was on the sea. Even when the results of defeats on land seemed to bring the American situation into a deadlock, memorials were being presented to the British Parliament in which the argument used to

bring about peace was the unprecedented destruction of British commerce. The reasons for these petitions become evident when we realize that American privateers, in the Revolution, actually destroyed about six hundred British ships of the value of eighteen million dollars. And these were great losses for the times.

From the very start American privateers had swarmed over the seas, and this implied the existence, at the outbreak of the Revolution, of an element of naval preparedness in the American Colonies which has not been appreciated. The fact was, there were no hardier and more intelligent seamen in the world than the Americans of 1775. Their ships had been on all the oceans navigated in those days, and American designers were already noted for the speed and stanchness of their ships. American sailors had also learned the lesson of experience in fighting on the seas, which made them especially well equipped for warfare against the commerce of a superior naval power. Just as, on land, the experience of the "French Wars" was of great value to American officers, from Washington down through all grades; so, on the sea, the experience of naval warfare in these same "French Wars" was for American seamen a preparation for their successful raids upon British commerce.

This publication of the Rhode Island Historical Society is a most interesting account of these earlier ventures in privateering which gave Americans their education for the naval warfare of the Revolution. In 1739 the assembly of Rhode Island had "authorized the governor to grant commissions to private men-of-war to act against Spain and the subjects thereof, pursuant to his Majesty's warrant." And later in the war, upon hostilities with France, Rhode Island privateers wrought such havoc upon French commerce that Richard Partridge wrote: "It is well known that the colony aforesaid is extremely obnoxious to the French and much an object of their resentment on account of the great mischief done to their trade during the last war by Rhode Island privateers of which they fitted out more than any other of the northern colonies." The author states: "The increase in the interest in privateering was greatly fostered by France's entry into the war, the lure of rich French prizes serving as an incentive to the cupidity of the New England merchants."

When we realize that "Rhode Island had twenty-one privateers [not including the colony sloop *Tartar*] at sea during the year," 1744, and when we also realize that "the crews of these privateers averaged more than 100 men per vessel," it will be evident that the small New England colony had sent many pupils to this school of naval warfare.

Mr. Chapin's book gives a vivid narrative of the cruises and

adventures of these privateers after the day of September 1, 1739, which marked "an epoch in the history of Rhode Island privateering. On that day two sloops, the *Virgin Queen* and the *Revenge*, sailed from Newport, the first privateers out of Narragansett Bay in King George's War." These were followed by many more, and their stories are stirring pictures of the old sailing days. The careers of the various ships are traced, with the right amount of detail and quotations from documents to bring the realities of those times before the reader's eyes—and yet the author has been successful in avoiding too long a book. There is much hard fighting, and every variety of peril from storm. One is made to realize what it meant to cruise in the enemy waters of the West Indies in the small craft of the times. Of the *Revenge* of Newport we learn that, after a succession of bouts with the weather, including a stroke from lightning which seriously damaged the ship, when the crew were at last able to take out reefs and get clear of the hurricane, the stern rebuke was recorded: "Very few godly enough to return God thanks for their deliverance." But no disapproval was expressed of the following: "One of the prisoners captured by Captain Norton [of the *Revenge*], a negro slave about thirty years of age, who was a carpenter and caulker by trade, and who also understood boat building, was sold at public auction at 6 P.M. on May 6 at the Royal Exchange Tavern in Boston."

An interesting episode in the book is the career of the "colony sloop" *Tartar*, which, although built, manned, and equipped by the colony of Rhode Island was given the status of a privateer by the British Admiralty. This armed vessel was used to protect the coast, for convoying, and saw service in the expedition against Louisburg. Others of the Rhode Island privateers had a hand in this undertaking of Governor Shirley's, which was one of the most enterprising and successful operation of the American Colonists in the "French Wars."

This is altogether a stirring book, and it is a valuable contribution to the literature of the sea, which is now teaching our people how largely our history was made upon the sea. This is much needed information for the American nation—and the present interest in books dealing with our past on the sea has been justified by our recent lessons from the World War. These showed that our present as well as our past must be influenced by the sea. It was proved that our innate inheritance from the sea was still strong in Americans, and this inheritance from the stormy days of our ancestors had fitted Americans on the sea for many and varied tasks that were not imagined before. We must never let this touch of the sea get out of our blood. And the more sea books we Americans read, the better it is for us.

THE SEALS OF MARITIME NEW ENGLAND. By Louis F. Middlebrook. Essex Institute, Salem, 1926.

REVIEWED BY CAPTAIN THOMAS G. FROTHINGHAM, U.S.R.

This is another valuable contribution of the Essex Institute, to add to the many from the same source which have done so much to spread the knowledge of our early maritime history. In the first paragraph of this book the keynote is struck: "But the origins of the first settlements were of the maritime nature, and it is concerning these, where the foundation of our Government was primarily established, that this work is devoted." And, in his preface, the author has defined his intention as follows: "One of the objects of this record is an endeavor to revive and resurrect local interest in the preservation and continuous survival of the original devices established as the seals of communities, unalterable and constant, as identifications of heridity to all concerned."

This makes an appeal at once to Americans, and Mr. Middlebrook has compiled an interesting monograph. It is a plea for a return to the original and characteristic forms of seals, which in many cases have been abandoned. As he states the case:

> The reasons for the adoption of an original seal belonged to the first settlers to interpret, and in examining some of the alterations that have been made in these historic standards, it almost seems blasphemous and bordering upon profanation that such pitiful substitute blemishes have been permitted.
>
> Commerce and the fisheries were reflected in the seals by various communities on the New England seaboard, but now only a few remain as originally drafted. Of the original coast colonies themselves, Maine, New Hampshire, and Rhode Island still maintain the maritime designs in their great seals, although it is true that Massachusetts and Connecticut also possessed seals of this order at one time in their history as is hereafter shown.

The old seal of the colony of Massachusetts Bay, which developed into the seal of the Commonwealth of Massachusetts, showed that "the presence of the Indian was probably more predominant in the minds of the settlers," and the Indian has retained his place in the present seal. There was the stage of the "Sword-in-hand" seal of 1775, with the motto *Ense petit placidam sub libertate quietam.* The "Sword-in-hand" is retained in the present crest, with the motto, but the Indian has returned to the field of the shield with a star "for one of the United States of America." Yet two Massachusetts seals are shown with nautical emblems, the "anchor and codfish" seal, and the "Pemaquid' seal with a ship. Connecticut adhered to the familiar grapevines, but a "ship" seal of that colony is also shown in this book.

Of the sea ports, many seals are reproduced which had their origin from seafaring, and which bore nautical devices, although here also there were many departures into other forms of em-

blems. Most of the old seals are of good design, and are in themselves an argument for harking back to the originals of the early settlers. In describing the various New England ports, of which the seals are reproduced, this monograph also gives a terse account of the origin and early history of each community. This is an interesting feature of the book and is well done.

There is also a short treatise on the making of seals, which includes this practical instruction from an old source:

> In order to form a better judgment of your work you must, now and then, as you proceed on, make use of a stump, made with a piece of an old hat rolled up and blackened, with which you rub your metal on the place you are working, which fills the strokes with black and makes you see better the effect of your work as you go on.

With this, there is a list of old New England engravers of seals. Among them appears the versatile and omnipresent Paul Revere, to whom is credited the "Sword-in-hand" seal of Massachusetts.

SAILING SHIPS OF WAR (1800-1860). By Sir Alan Moore (Bart.). Minton, Balch & Co., New York. $25.00.

Reviewed by Rear Admiral (Ret.) Elliot Snow, (CC) U.S.N.

[Editor's Note: The following review, an excellent one, appeared in the Army and Navy *Register* of October 9, 1926.]

Sir Alan Moore (Bart.), whose book *Sailing Ships of War* has just made its appearance, chose his subjects from the period of 1800-1860 and, for his illustrations, drew entirely upon the finest and nearest complete collection of maritime prints of the world—that of Mr. A. G. H. Macpherson. The preface of this book justly states: "Those who share his [Mr. Macpherson's] tastes owe him a debt for enabling them thus far to share his treasures."[1] To this it may here well be added that the worlds of art and naval history, too, are in debt to Sir Alan Moore for choosing so happily and so well presenting his interesting subject.

"The purpose of this book," say its author, "is to show what men-of-war were like when the sailing navy reached its zenith during wartime, and how its likeness was retained as far as possible for more than fifty years in spite of steam." A few ships of a date earlier than 1800 are included to constitute a link between eighteenth and nineteenth century practices and one, a couple of years later than 1860, "shows unmistakably the passing of the epoch of sailing ships of war." The *U. S. S. Kokuk* (1862),

[1] Among the other works which have drawn upon this collection, several of which have already been reviewed in the Army and Navy *Register*, are: *The Sea: Its History and Romance*, by F. C. Bowen; *Adventures by Sea*, by Basil Lubbock; *Yachts and Yachting*, by B. Heckstall-Smith; *The Golden Age of Sail*, by F. C. Bowen, and *Whaling and Whale Ships*, by G. F. Dow.

when contrasted with the *U. S. S. Lancaster* (1858), discloses the rapidity of changes in our ideas of men-of-war wrought during four years, at the time of our Civil War.

For each of the sailing ships-of-war dealt with, the author has given a brief sketch of some interesting and stirring scene connected with her service as well as her principal characteristics. For the most part the vessels selected to accomplish the purpose of the author were at one time units of the British fleet. However, ten or twelve vessels of the United States, and here and there one of France and other countries, are included. Among those of the United States is the *U. S. S. Constitution,* an engraving by A. Bowen, after W. Lynn. The one text illustration is that of the sheer and half breadth plans of "Old Ironsides" made from a copy in the files of the Bureau of Construction and Repair (1794). Others are an American sloop, probably of the *Hornet* class; one of the *U. S. S. Fulton,* published in 1815; the U. S. frigate *Cumberland,* launched in 1842; the paddle frigate *Missouri,* which caught fire and burned to the water's edge at Gibraltar on August 26, 1842, through the accidental breaking of a jar of turpentine; our largest line-of-battle ship *Pennsylvania* (140), of which a model is today to be seen in the conference room of the Navy Department library.

In addition to the descriptions of individual ships, the author has given attention to sailing ship traditions; a description of the rates and classes of vessels which, then as now, reached a number quite bewildering to laymen; a table compiled chiefly from an Admiralty manuscript entitled "A List of His Majesty's Royal Navy, 1798-1805"; a section on guns showing where many types were used and how worked, taken largely from a recent work by F. L. Robertson, engineer commander, Royal Navy.

From the sections devoted to seamanship and the working of guns, the reader will learn that even to this day "a recruit for the [British] Navy takes no oath of allegiance as a soldier does." The rapidity with which vessels could be rigged and otherwise prepared for service in early days is somewhat astonishing. "About 1850 two line-of-battle ships, fitted out as quickly as possible by Admiralty order were masted, rigged, armed, and stored in . . . . about three and a half days."

The section next following the one on seamanship is devoted to changes and developments in construction. These, however, were relatively small during the period dealt with, though many minor alterations were made. "Even so unimportant a matter as replacing the spritsail yard [by whisker booms] was long delayed and opposed." The last eight pages of the introduction touch briefly on the struggle between sail and steam. "'Till the early thirties

the use of steamers as fighting units was hardly considered," though the Hon. East India Company's *Diana* had been found useful during the river campaign of the Burmah War of 1824.

The color reproductions add much to the attractions of the book. Of the twelve, one is Roux's beautiful water color of *l'Incorruptible* of the French Navy. This vessel narrowly escaped destruction at the hands of the British fire ships in Dunkirk Roads (1800). Another shown is the *Guadalupe,* said to have been the first iron man-of-war launched at Birkenhead (Laird), 1842. She was built as a private enterprise, and not being wanted by the British Government was sold to Mexico. The Symondite corvette, H. M. S. *Dido,* which was famous for her smart and neat appearance, is illustrated. Some hold that her smartness gave rise to the expression "cutting a dido."

A few of the eighty odd cuts in black and white, which show scenes like those "On the Deck of a Man-of-War, 1820," and "The Midshipmen's Berth," introduce a variety of interest which will attract the attention of those who are seeking information as to former seafaring customs and ways. In the first-named picture the author points out "a steady-going seaman reading a letter out loud . . . . . ." On the far side of one of the ladders "a man is answering a tall-hatted officer's inquiry about some infernal row" unnoticed by a sentry. "A group of gamblers limits the space available for the innocent amusement" of dancing. "Under cover of watching the dance a prearranged exchange of liquor is taking place." There is a Jewish peddler; an arrival and a parting; two of the men have pigtails. This form of headdress came into fashion about 1786 and died out in the twenties.

The book is very well indexed. Because of the predominance of English vessels, its greatest appeal is to our English cousins across the Atlantic, yet the book contains interesting bits of the history of ships that will interest, as well, those on this side of the Atlantic.

AIRCRAFT AND COMMERCE IN WAR. By J. M. Spaight. Longman's, Green and Company, New York. $2.25.

In this very interesting book Mr. Spaight develops the fact that sea power and air power can, in conjunction with trade agreements, exert irresistable economic pressure on an enemy which is weaker at sea. The book, however, by its title and general point of view rather emphasizes the part of air power in exerting this pressure at the expense of the real essential—*sea power.*

Aircraft must operate from a base either afloat or ashore. If aircraft are used as an information service and adjunct to the sur-

face vessels of the stronger sea power the nature of maritime warfare will be changed but little. If aircraft are operated from the shore bases of the weaker sea power against the sea communications of the stronger it seems inevitable that the air forces of both belligerents, as well as portions of their fleets and armies, will be employed in a struggle for the possession or destruction of such bases. Thus the air efforts of the weaker sea power will soon be diverted from attack on shipping to attack on enemy armed forces engaged in attacking its air bases. The war in the air would rapidly change from Mr. Spaight's conception—war by economic pressure without battle—to the inevitable military encounter and decision by battle or the conception of war which he rather deprecates. It would develop into a struggle for aerial supremacy in the theater of war and aerial supremacy would be found to be largely dependent on the seizure or defense of operating bases for surface forces. A principle which can not be discounted is that before one can *exercise* the command of an area either by land and sea or by air one must *secure it.* There is only one way to secure command against an enemy who wishes to dispute it and that is by battle.

It seems rather doubtful if any nation will attempt to secure victory over an opponent by economic pressure without a decision by battle unless the economic resouces of its enemy are small particularly after the experiences of the past ten years. Victory by economic pressure has turned out to be a rather doubtful method of winning a war.

F. S.

SECRETARY'S NOTES

Circulation

The circulation of the PROCEEDINGS since January, 1926, has increased 672 copies; the membership of the Institute has increased 394 members.

Increase in advertising pages

The Secretary is glad to announce that the amount of advertising in the PROCEEDINGS is steadily increasing, and the November issue had a total of twenty-eight pages of advertising. The net result has increased the revenue from this source a very considerable amount, and the money is being used to improve the PROCEEDINGS as much as possible.

An Echo from Navy Day

The Secretary was pleased to receive in the mail the other day the following letter:

Editor, U. S. NAVAL INSTITUTE

DEAR SIR:

Being a member of the Institute and interested in the Navy, I made it a point to be on hand when Admiral Henry A. Wiley, U. S. N., came to Minneapolis recently to help us celebrate Navy Day.

In most of the discussion relative to the proposed changes in the form and policies of the U. S. Naval Institute there is an apparant agreement that one of the primary objects of the Institute, if not of the Navy itself, is to bring about on the part of the general public, a greater interest in the Navy.

To attain this end, Navy Day has been set aside—very appropriately on Roosevelt's birthday. The last one just held in Minneapolis, was introduced by Mayor Leach's proclamation in the local newspapers. But the actual "hit" was registered by Admiral Wiley. His visit did much to obtain the objective, for by his pleasing personality and modest but clear-cut talk on things pertaining to the Navy, he created a very favorable impression on the three thousand or more students and other visitors assembled in the university armory. Such a favorable reaction to the service is of real value when one reflects that this audience—already selected for higher education—will later become an influential element in the community.

And Admiral Wiley most obviously won his audience. He pointed out that the Navy was not solely a weapon of destruction but that in peace time

it was an active means of business expansion and for the promotion of friendly relations among the nations of the world. With becoming modesty, he indicated the diplomatic achievements of the Navy, citing the commercial agreements made with China in 1842 and with Japan in 1854 when that country for the first time in its history was opened to Occidental trade. To show the need for a well-trained personnel attention was called to the fact that in all walks of life, training is essential; that skill and experience born of much practice were especially vital in emergencies and in the handling of complex or dangerous machinery. He pictured the fleet steaming at great speed, the ships being at intervals of five hundred yards, which, he explained, meant five hundred yards from foremast to foremast, and that the actual distance between ships was less than a ship's length, and let us imagine the dire results if the officers and men were not sufficiently trained. He mentioned also airplanes, submarines, and other units which require a similar high degree of intelligence and preparation.

On the other hand, such training, he said, had an immediate value for the individual. Military training was shown to be of lasting benefit in that it sets one up physically and teaches the important lessons of life, teamwork, obedience, and loyalty. As the Admiral remarked, "Few of us are so fortunate as not to have to take orders from someone." Success comes only to those who have acquired by long discipline a sense of subordination and loyalty to a superior, to their fellows, or to a common cause.

To offset some of the shortcomings of Navy life, such as being away from home "Not any longer, on the average, than the average business man, but for longer periods at a time," some of the brighter phases of Navy life were mentioned. The Admiral was for a moment reminiscent as he spoke of the recent trip of the fleet to Australia and New Zealand. "Hardy as we were" he said, "We could scarcely stand up under their hospitality." He described the hearty welcomes and other acts of friendliness on the part of the inhabitants, as well as their profuse invitations to come again. (Can this be the same belligerent navy which hot-heads would have us believe is a monster existing only to destroy?)

The newspaper clippings enclosed will indicate in some measure how Minneapolis reacted to the admiral. His visit has undoubtedly secured many new friends and aroused much favorable interest in the U. S. Navy.

N. B. The quotations are made from memory; if they are in any way erroneous, the fault is mine.

New Textbook on Navigation

The Naval Academy authorities have recently adopted as the standard textbook for the instruction of midshipmen in the subject of navigation a book recently published by the Naval Institute entitled "Navigation and Nautical Astronomy." The author, Commander Benjamin Dutton, U. S. N., worked three years on this textbook, two years of which while serving as Executive Officer in the De-

partment of Navigation at the Naval Academy. The Secretary has received a letter from Commander Radler de Aquino, Brazilian Navy, in which he says of the book: "Limited by its scope, I believe Commander Dutton has produced a work of a basic character hard to match." The last chapter in the book brings the whole subject of the uses of the mooring board up to date, and in a manner that is believed by the academic authorities best suited for presentation to the midshipmen. The price of the book is $5.50, postpaid.

Changes in "Proceedings"

Commencing with the January, 1927, issue of the PROCEEDINGS, the entire contents will be printed in the same size type, viz., 10 point, solid. The pages will be printed double column and the page size increased to 6⅝ x 9¾. A dull paper will be used, which will be easier to read. This paper, while it costs at least $800 more a year than the paper now used, is believed to be worth the difference. There will be no changes in the general appearance or name of the PROCEEDINGS. The Board of Control hopes that the changes referred to will result in a better and improved PROCEEDINGS.

The January issue

The January number will contain the following articles: "The Broad Aspect of the Pacific," by Rear Admiral W. V. Pratt, U. S. N.; "The Dedication of the St. Nazaire Memorial," by Rear Admiral Albert Gleaves; "A Study of the Relative Movement of Ships," by Rear Admiral L. M. Nulton, U. S. N.; "Modern Methods in Sea and Air Navigation," by Commander Radler de Aquino, Brazilian Navy; "Submarines and Disarmament Conference," by Captain W. S. Anderson, U. S. N.; "Discussion of Limitation of Armaments," by Rear Admiral W. L. Rodgers, U.S.N., "An Unusual Picture of Washington," by Lieutenant Commander S. L. H. Hazard, U.S.N.

Increase of Essay Award for Prize Essay Contest

The Board of Control has approved a recommendation received from a member of the Institute to amend the Constitution and By-Laws of the Institute in such a manner as to increase the amount of the Prize Essay award from $200 to $500. This proposition will be

placed before the entire membership for a vote; and, if approved, it is hoped that it will stimulate further interest as well as improve the character of articles submitted in the contest. Of course, this change, if approved, would only affect the award beginning with the Prize Essay Contest for 1928.

The value of "Proceedings" to members

No doubt, occasions will arise where members can be of much benefit both to their friends and to the Naval Institute, as will be seen from an extract quoted below, taken from a letter written by an associate member of the Institute to his friend, a copy of which was sent to the Secretary:

MY DEAR ———:

In accordance with promise inclosed tracing of the Maublanc-Lallie propeller, taken from the "Professional Notes" of the U. S. Naval Institute PROCEEDINGS September, 1926 issue; this single issue, by the way, to a marine engineer like yourself, is worth an entire year's subscription.

Note the cone shaped hub and the lines of the blades which on test have given about 16 per cent more efficiency than the ordinary type. Of course we are after power and speed is a secondary consideration, but the slope of the blades in the above seem to me, at least, to indicate that there would be less danger of breaking blades through striking driftwood, than with the ordinary type. The pitch of the blades would have to be adapted to the intended use naturally and so have to be designed for our purpose, but so far, am strongly inclined to use them on our boat unless we decide upon stern wheel drive.

You will also find in the above mentioned September issue a review of the new Ingersoll-Rand Oil Engine, as well as a review of the heavy duty Worthington Marine Oil Engine, both of which would interest you I am sure.

Notes from Foreign Periodicals

The Institute is taking steps to have translated the important professional items from foreign language professional periodicals, for inclusion in the "Professional Notes." It is hoped that this will help members to keep themselves more fully informed of the best professional thought of foreign countries.

Kedging the "Constitution"

The article "Kedging the Constitution," by Lieutenant Commander H. D. McHenry, U.S.N., which appeared in the August issue of the PROCEEDINGS, has been the subject of correspondence between the Secretary-

Treasurer and Mr. J. Bernard Walker, Editor Emeritus of the *Scientific American*. In the December, 1925, issue of that magazine there appeared an article on the type of kedge anchor used by the *Constitution*, and the question has been raised as to whether the kedge anchor discussed by Lieutenant Commander McHenry, an illustration of which appeared in the PROCEEDINGS, is really the one used by Captain Isaac Hull, of the *Constitution*. The Secretary has initiated steps to obtain as much information on this subject as possible and trusts that he may be able to publish in the near future such facts as have been brought to light.

Money may be left to Naval Historical Foundation

Captain Ridley McLean, U.S.N., recently offered a suggestion with regard to a form for bequests for any one desiring to leave by will money to the Naval Historical Foundation. This organization has informed the Secretary of the Institute that the following form is in all respects legal and effective:

"I give, devise, and bequeath $———, to the Naval Historical Foundation, duly incorporated in the District of Columbia."

The Naval Historical Foundation is already in receipt of valuable historical papers

Captain Dudley W. Knox, of the Naval Historical Foundation, has informed the Secretary that the president of the Foundation, Rear Admiral Austin M. Knight, has written to the son of the late Rear Admiral T. O. Selfridge, Mr. George S. Selfridge, thanking him for the large collection of naval historical material which he presented to the Foundation. Following is a letter showing the list of historical papers received:

16 October, 1926.

MY DEAR MR. SELFRIDGE:

It gives me especial pleasure to acknowledge your exceedingly generous gift of historical material, as listed below, to this Foundation. The receipt of such a large and interesting collection is encouraging evidence of the value of the Foundation in accomplishing its principal object of preserving the sources of our splendid naval traditions, in the making of which your family have played such a conspicuous part.

I assure you that your generosity is greatly appreciated by myself and the other trustees, and that the greatest care will be taken to safeguard these important records of our Navy's history.

Journal of cruise in the ship *Eagle*	1816-20
Journal of cruise of U. S. L. B. ship *Columbus* and Brig *Barbara*	1820-21 1824
Journal of cruise of ship *Union* and Brig *Romulus*	1821-23
Journal of cruise of U. S. S. *North Carolina* and U. S. S. *Natchez*	1825-26 1829
Journal of cruise of U. S. S. *North Carolina*	1837-39
Journal of cruise of U. S. S. *Columbus*	1846-47
Journal of cruise of U. S. S. Sloop *Dale*	1847-48
Journal of cruise of U. S. S. Sloop *Dale*	1847 (Sept.-Nov.)
Journal of cruise of U. S. S. *Independence*	1854-56
Journal of cruise of U. S. S. *Mississippi*	1861-62
Journal of Darien Ex. Expedition	1870-73
Journal of Darien Ex. Expedition	1870 (Feb.-June)
Journal of Amazon Expedition	1878
Letter-book of Captain T. O. Selfridge, Sr.	1847-62
Letter-book of Captain T. O. Selfridge, Sr.	1863
Letter-book of Commo. T. O. Selfridge, Sr.	1866-68
Letter-book of Commander T. O. Selfridge, Jr.	1867-70
Letter-book of Commander T. O. Selfridge, Jr.	1870-71 1871-72
Letter-book of Commander T. O. Selfridge, Jr.	1875-77
Letter-book of Commander T. O. Selfridge, Jr.	1877-79
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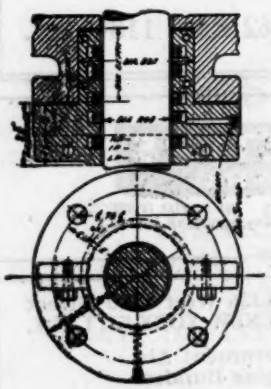

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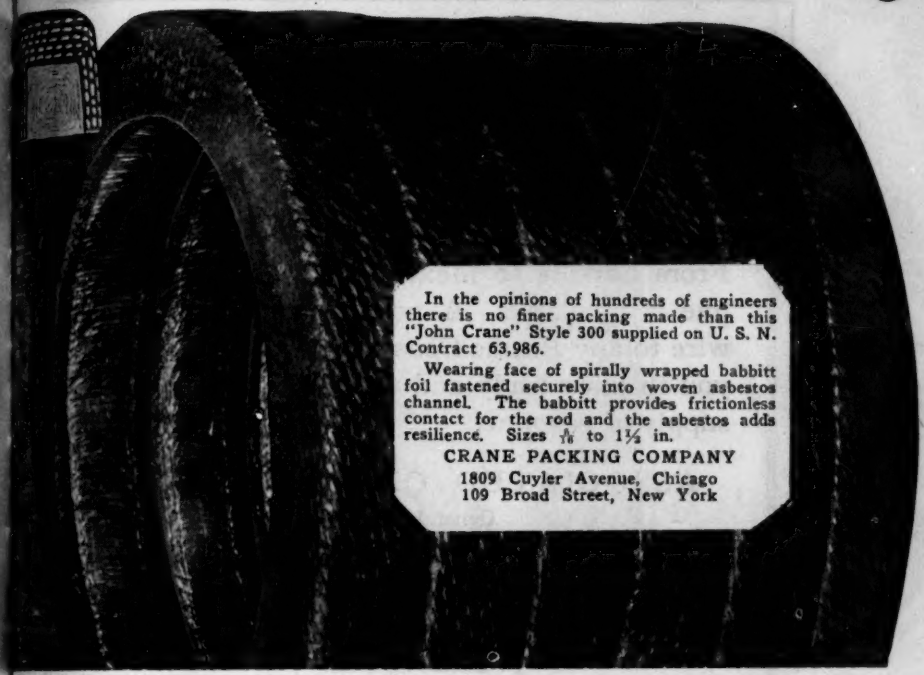

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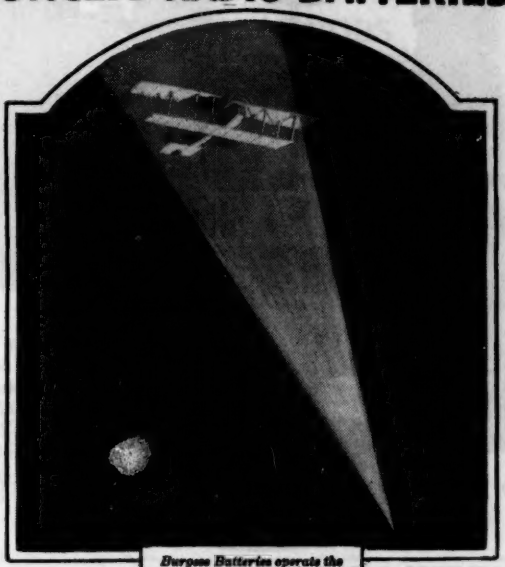

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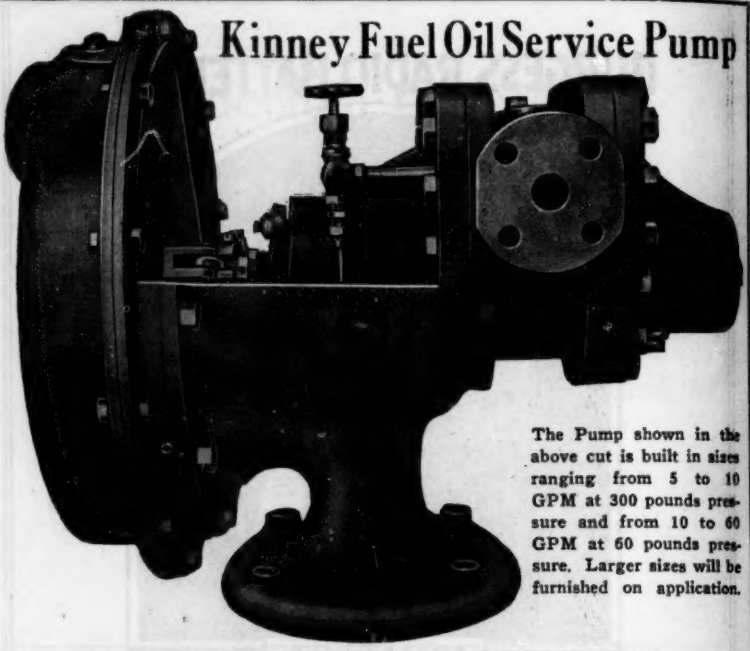

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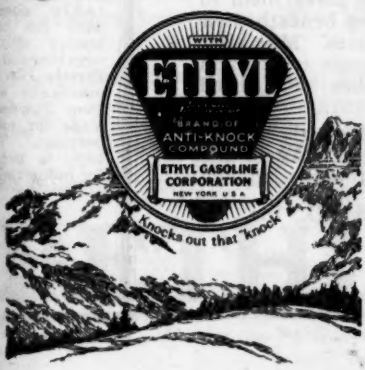

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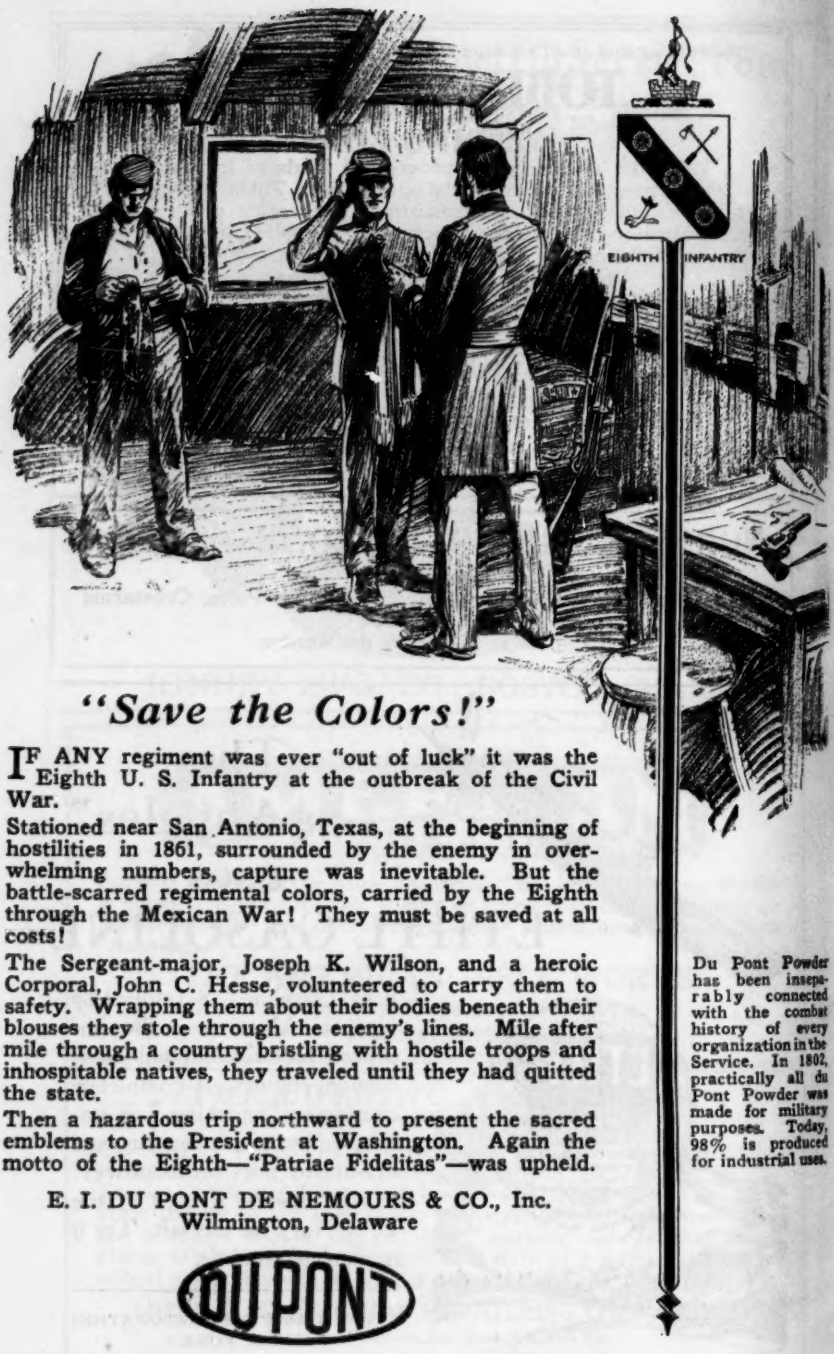

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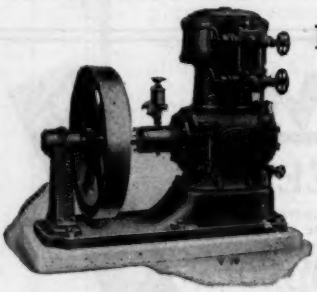

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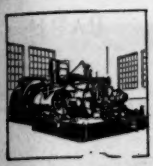

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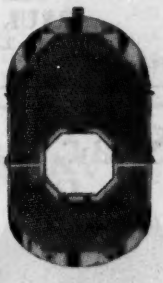

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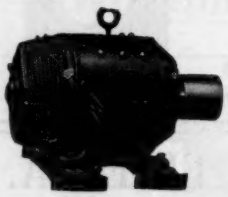

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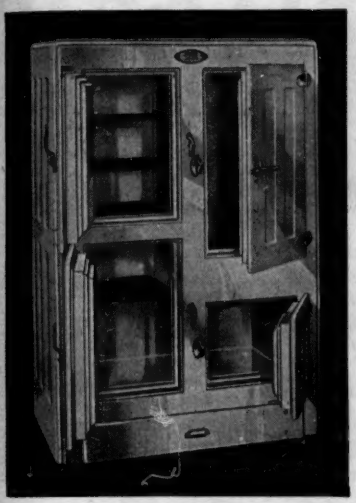

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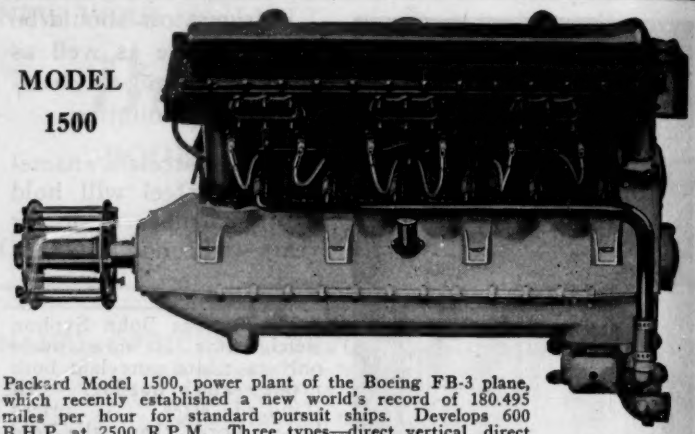

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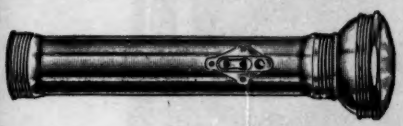

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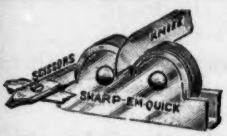

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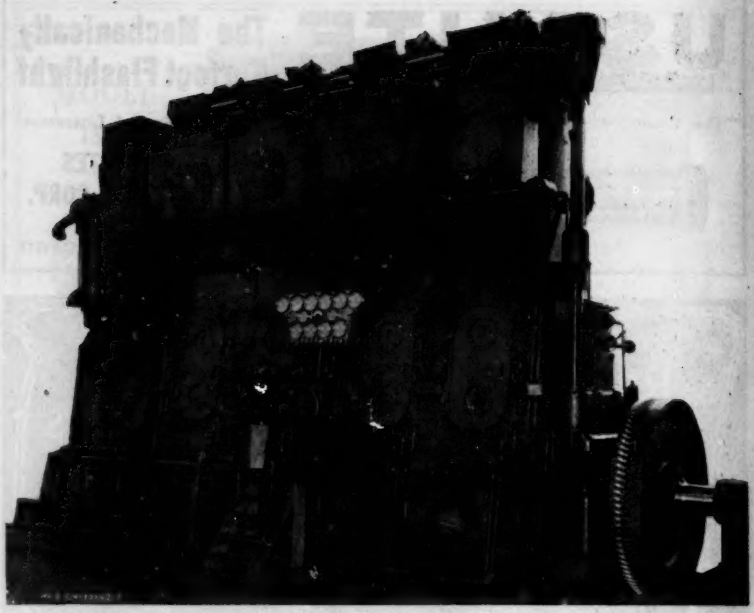

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